

Nature, Change and Agency in Aristotle's *Physics*

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Abstract of Contents

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Chapter I. Nature as Inner Principle of Change

The concept of "nature as inner principle of change" is fundamental to Aristotle's theory of the physical world; it is the object of the present thesis to substantiate this claim by tracing the effects of this idea in Aristotle's rejection of materialism, in his doctrine of "natural places", in his definition of change and process in general, and (*via* the latter) in his notion of agency in general and the supreme Unmoved Mover in particular ((1)). Aristotle elucidates "natural" by contrast with "artificial" ((2) - (3)), holding that natural substances not merely collectively ((4) - (5)) but as individuals each possess an 'innate impulse of change'. But this must be explained so as to allow for the fact that no change is entirely independent of external conditions ((6) - (7)). If, however, change were totally dependent on external conditions, its occurrence would be inexplicable ((8) - (9)), and the very concept of "change" would be incoherent. This latter conclusion emerges from an examination of the ancient paradox of becoming and Aristotle's treatment of it ((10) - (33)). The paradox is expounded ((11) - (14)). Aristotle answers it by showing that language assumes a continuing subject of change ((15) - (21)). But this assumption meets the problem only if the metaphysical category of substance is also assumed, and along with it some distinction between substance-constitutive and non-substance-constitutive characteristics ((22) - (27)). The former mark off their subject as a thing of a certain causal type; thus change, in presupposing a substantial subject (see also Appendix to Chapter 1), presupposes one that makes some causal contribution to its own changes ((28) - (33)). But Aristotle means more than this by 'nature as inner principle'. He holds a natural substance to be (like a craftsman) the autonomous determinant of certain changes; these therefore (by contrast with changes not so determined) are "natural", as manifesting the substantial nature ((34) - (36)). This problematic notion is taken for granted by Aristotle in the *Physics* ((37) - (39)), but can be seen to rest on his metaphysic of substance. It is a consequence of this that the natural change of a given substance be of one kind and display a

unitary pattern reflecting the unity of the substance ((40)). This view cripples scientific method as we understand it ((41)), but Aristotle's idea of substance anyway cuts him off from the approaches successfully operated in later mechanics and chemistry ((42) - (45)). A summary of the ground so far covered ((46)) introduces a further sense in which Aristotle's natures are "inner" principles of change: the subject of change is not (as in artifice) external to the being which is the source of change ((47) - (54)).

Chapter II. What Things Have Natures?

Aristotle begins *Physics* II 1 with a list of organic and inorganic things 'manifestly' possessing "natures" in the sense explained. But our explanation has left open the question of the extension of this concept, and supplies as yet no theoretical justification for his choice of items on the list ((1)). Aristotle's inclusion of complex objects such as organisms raises a problem. Whatever has a "nature" is a substance, and a substance is a *per se* unity; but how can something complex and composed (as are organisms) of simpler substances be such a unity ((2) - (7))? Aristotle is entitled to count organic creatures as substances (and for him they are so *par excellence*) only if, as against the "materialists", he can show them to be more than mere arrangements of components ((8) - (9)). In *Physics* II 1 he presents (without distinguishing) two materialist positions: one (i) identifies an object's "nature" with its proximate matter; the other (ii) asserts the simple bodies to be 'the whole of substance' ((10) - (11)). In II 1 he argues against (i) alone, with varying success ((12) - (20)). But it is (ii) that poses the graver threat to his view of organisms as *per se* unities ((21)). This view, which Aristotle at no point abandons, connects closely with his doctrine of necessity and his teleology ((22) - (25)). But has it any firmer ground than a presumed analogy between nature and artifice ((26) - (27))? Aristotle's reasoned defence comes in *Physics* II 8, where he argues against Empedocles' version of the second materialist position as applied to organic structure and development ((28)). Aristotle's argument has apparent flaws ((29) - (33)), but is effective in the context of the view that the simple bodies are substances that express their natures through locomotion in diverse directions ((34) - (41)). On this premiss, neither mechanical ((35) - (36)) nor chemical

((37) - (39)) combination could account for organic phenomena. Hence Aristotle has a rational basis (a) for regarding organisms as *per se* unities endowed with substantial "natures", and (b) for his teleology ((41)). Despite their close connection, (a) and (b) are not to be equated ((42)). Aristotle's theory of organic substance is (*pace* A. Gotthelf) fundamentally metaphysical ((43)).

Chapter III. The Definition of Change

In *Physics* III 1 ff. Aristotle undertakes to elucidate 'change' ('μεταβολή') and 'process' ('κίνησις'). Although the terms are not synonymous he treats them here as interchangeable, *i.e.* as if all change were process. This tacit restriction of the meaning of 'change' is due (it is argued in this chapter) to his preoccupation with "natural" change, although "nature" (as he himself makes clear) is only one type of source of change ((1) - (3)). Under the general concept "change" we may distinguish (a) that of the "emergence" of some new property and (b) that of "process", which includes conditions leading up to an "emergence" ((4)). The concept here sketched of "process" leaves open the question of mathematical continuity; it also allows a subject to be regarded as 'in process' on account of imminent causal activity in some other subject. This entails that there is no contradiction in predicating (as Aristotle occasionally does) the term 'process' of a subject which passes all at once from an old to a new state ((5) - (6)). Many phenomena can be described either as emergences or as processes, although locomotion has to be regarded as process ((7)). But in *Physics* III Aristotle assumes that all change-phenomena are to be approached *via* the concept of "process". This is because he cannot otherwise preserve the metaphysical connection between "change" and "natural substance" ((8) - (9)). This is easily shown for organisms ((10) - (11)). The simple inanimate bodies can be accommodated to his scheme by supposing an absolute difference between "upwards" and "downwards" (*i.e.* the doctrine of "natural places") ((12) - (14)). Change, on this view, is necessarily directed to a *terminus*; thus it may be regarded as "incomplete", which for Aristotle is what fundamentally distinguishes it from conditions of non-change ((15)). This "self-terminating" character of Aristotelian change is what makes it especially puzzling, more so than Plato's "becoming" ((16) - (17)). We now consider in detail the account of

III 1 ((18) ff.) Since change or κίνησις expresses substance, it too must be real and actual; hence not only must every characteristic changed from and to fall into some definite category, but so must change itself. Aristotle puts it into the category of "Relation" for want of a better, thereby committing himself to the view that all change involves an agent-patient relationship ((19) - (20)). Although obscure, the formal definition of κίνησις in III 1 is not circular; this is clear once its reference to 'potentiality' is correctly interpreted ((21) - (24)). It permits adequate distinctions between actual change, the actual subject, and the actual condition in which a change terminates ((25) - (26)). It entails a fundamental type-difference between change and non-change ((27) - (28)), and shows why earlier thinkers were so mystified by this topic ((29)). Aristotle's own doctrine of substance and the Categories turns out to depend on his conception of change as self-terminating ((30) - (32)). The III 1 definition can be interpreted in two ways; according to one of these the subject need not undergo perceptible transition ((33) - (35)). But this definition covers only natural and purposed change or κίνησις ((36) - (38)). However, in *Physics* VI Aristotle attempts another account (not that he ever appears to renounce that of *Physics* III); the metaphysic of nature and substance is now in abeyance and the central concept is the inclusion, by any one change, of infinitely many temporally (and in some cases spatially) smaller changes ((39) - (42)). Change is now distinguished from non-change in a way requiring the former to be temporally intermediate between its *termini* (which was not necessary on the account of Book III) ((43)). But qualitative change is made to fit this scheme only by a bad argument, whose force Aristotle himself refuses to acknowledge in another context ((44) - (50)). Still worse problems are generated by his continuing assumption that change is directed to a *terminus* ((51) - (52)). The attempt to combine this with the analysis in terms of mathematical continuity produces paradoxes ((53) - (55)), as Aristotle realised when he came to work out the cosmology of *Physics* VIII. Thus in VIII 8 he argues against the Book VI view that a change consists of infinitely many shorter changes, and there he also abandons the associated view that change necessarily occupies a period of time between its *termini* ((56) - (59)).

Chapter IV. Agent and Patient

In the *Physics* the notion of "agent"/"patient" (κλνοϋν/κλνοϋμενον, "changer"/"changed") is more closely linked than any other to the concept of change. In III 3 Aristotle reformulates his definition of the latter in terms of agent and patient. His grounds are obscure, like much else in his treatment of agency ((1) - (3)). But clearly he holds that (i) for every change (κλνησις) there is a changer (κλνοϋν); (ii) the changer is distinct from the changed (or subject of change); (iii) to act as a changer is not to change (intransitive) ((4)). The first position may have seemed plausible because 'κλνεϋν' has to be put in the grammatical passive to express intransitive change. Thus rules of grammar prescribe that for every κλνησις there is a κλνοϋμενον; but this alone does not validate an inference from 'κλνησις' to 'κλνοϋν' ((5) - (6)). In III, Aristotle identifies the "changer" as that which confers the form typifying the change. But in natural change the substance whose nature dictates the form is also the subject of change. Aristotle can only preserve position (ii) above while continuing to hold (i) universally by shifting the meaning of 'changer' so that it no longer implies 'that which confers the form'. This he does in VIII 4, where the "changers" responsible for the natural motions of the simple bodies are now identified with the generators of those substances and with whatever releases them from hindrance ((6) - (11)). Here Aristotle shows that he takes κλνησις as such to be a form of "suffering", not on account of its dependence on external circumstances (this holds too for non-passive conditions) but simply because it is κλνησις ((12)). After a summary of the positions that have so far emerged ((13)), we consider the difference between "real" and relational change. This may seem to support Aristotle's principle that all change has an agent, for "real" change must be referred to a cause standing in a particular relation to the subject ((14) - (17)). But the same is true of "real" (as opposed to relational) non-change properties ((18)). Attention now shifts to Aristotle's position (iii) above, and centres on paradigmatic agent-patient cases where one distinct individual substance acts upon another ((19)). In considering these we have to bear in mind the question (inevitable since Hume) whether the language of 'agent'/'patient' ought not to be altogether discarded, as misleadingly suggesting some occult process of "acting upon" ((20) - (21)).

Meanwhile we follow Aristotle's argument for (iii) in *Physics* III 3, where he principally relies on the insight that in any given case agency and patiency are one concrete event ((22) - (25)). This argument falls short of demonstrating (iii) ((26)), but the latter proposition can be further supported by means of the ἐνέργεια/κίνησις distinction of *Metaphysics* Θ 6. From one point of view the exercise of transitive agency is ἐνέργεια as opposed to κίνησις ((27) - (33)). Is it some occult "extra" transaction ((34))? Aristotle's treatment of cases such as heating shows this idea to be as alien to him as to Hume, although for Aristotle, unlike Hume, this implies no paradox ((35) - (36)). But not all cases are so simple, and transitive agency sometimes involves changes in the agent ((37) - (39)). But these are not distinct and conceptually self-sufficient; they are "parts" of one change, whose subject is the patient ((40) - (42)). The upshot is that although for Aristotle agency is no kind of extra occult transaction, the language of agency performs an indispensable function ((43)). However, problems about the status of agency disappear on one interpretation of Aristotle's insight that acting and being acted upon are the same concrete event. Theoretically this could be taken to imply that there is no actual agent and patient. But this view (which goes beyond any of Aristotle's) allows no purchase for the notion of executing an intention ((44) - (46)).

Chapter V. Self-Change and the Eternal Cause

The notion of something's changing (transitive) itself is baffling but vital to the cosmology of *Physics* VIII ((1)). "Self-change" is a species of "natural change", applying (in the sublunary world) only to organisms ((2) - (3)). It is not independent of external conditions; its special feature is a logically complex subject comprising a distinct agent and patient ((4) - (5)). In this Aristotle's concept of "self-change" differs from Plato's ((6)). But does Aristotle's make sense? He offers no explicit justification and ignores the metaphysical problems ((7) - (9)). He lists the criteria for "self-change", apparently identifying the agent-element with soul, the patient with body ((10)). But what is the point of introducing the concept anyway ((11))? Sometimes a live creature as an organic whole acts contrariwise to the natural tendency of some physical part: 'self-change' is an appropriate term for this situation, but Aristotle,

puzzlingly, also applies it even when no subordinate tendency is overridden ((12) - (13)). His failure in *Physics* VII to discuss the difficulties of "self-change" is due (it is suggested) to the fact that he employs it only as a step in a wider discussion, now to be examined, concerning the eternity of change ((14)). Is change eternal? On this depends the validity of the concept of natural substance developed in Book II ((15) - (17)). In considering objections to his own affirmative answer ((18) - (19)), Aristotle acknowledges a difficulty in reconciling it with the fact that some changes begin and cease ((20) - (21)). For the eternity of change presupposes an absolutely changeless cause, whose effect must resemble it in endlessness ((22) - (23)). Temporally finite changes cannot therefore be immediate effects of the ultimate changeless cause. Hence Aristotle postulates an intermediary consisting in an eternal change, which is suitable (because eternal) to be the effect of the changeless, and (because a change) to be the cause of transient change. The eternal change has an eternal body for its subject. Thus for Aristotle, (a) the fact of temporally finite change, and (b) the doctrine that change as such is eternal, jointly entail that there exists something absolutely changeless and something else always changing ((24)). The weakness of this position lies not (*pace* F. Solmsen) in any clash between the doctrine of an ultimate cause and the concept of nature as inner principle of change ((25) - (26)); but rather in the absence of proof that the subject of eternal change might not itself be the change's ultimate source ((27) - (28)). But cover for this logical gap is tacitly provided by the concept of "self-change", introduced to uphold a distinction between subject and agent of eternal change ((29); see also Appendix to Chapter V). However Aristotle fails to prove this concept applicable in the eternal realm ((30) - (33)). "Self-change" can be explained so as to make sense in connection with sublunary organisms, but in ways that do not touch the eternal case ((34) - (37)). Nonetheless, Aristotle tries to demonstrate a universally applicable distinction between agent and patient in self-change by means of the Law of Non-Contradiction; this involves modelling "change" on "acquiring", a move which lends colour to the charge that he indulges in "occult causes" ((38) - (41)). Why need he separate the ultimate source from the subject of eternal change. The reasons are not only theological ((42)), but also derive from the concept of

change and κίνησις as "incomplete actuality". His only ground (it is argued) for regarding eternal change as "incomplete" is its passive status, *i.e.* its dependence on an agent distinct from the subject. Thus in maintaining this distinctness in *Physics* VIII, Aristotle ensures conformity of eternal change to the *Physics* III definition of κίνησις ((43) - (51)).

CHAPTER I

Nature as Inner Principle of Change

- (1) 'The physical doctrines of Aristotle are a disappointing chapter in the history of science ... The science of the Renaissance period was obliged to shake off the fetters of Aristotle's authority before it could return to the paths of fruitful and progressive research.'

These remarks of Theodor Gomperz¹ voice a common verdict on Aristotle's philosophy of nature. It is not my purpose here to endorse this verdict, nor to challenge it, but to show how the characteristically Aristotelian doctrines on which it has been passed stem from one fundamental idea. This is the conception of a natural substance as characterised above all by an "inner principle of change and stasis". This notion of "the nature of a thing" links Aristotle's metaphysic of substance to his physical system, and it determines almost every one of that system's distinctive doctrines. It will be the object of the present work to support and illustrate this claim in detail. It will be shown, for instance, how Aristotle's concept of natural substance issues in a theory of living things as irreducibly organic unities, and hence in the rejection of materialism in favour of teleology. The same concept will be seen to generate his doctrine of the simple bodies' "natural movements" and "natural places". Not only Aristotle's cosmology but his chemistry too can be traced back to this principle, and on a more general level it shapes his entire conception of change and process. This in turn dictates Aristotle's denial of change to agents of change; and from the same source, finally, come the culminating doctrines of eternal motion and an eternal unmoved mover.

1. *The Greek Thinkers*, vol. IV, p. 108.

'The least initial deviation from the truth is multiplied later a thousandfold ... The reason is that a principle is great in power rather than extent; hence that which was small at the start turns out a giant at the end.' (*De Caelo* I 5, 271b8ff.)

The words with which Aristotle prefaces his own attack on the notion of infinite body could be aptly quoted back at him by critics such as Gomperz, with reference, this time, to the Aristotelian concept of natural substance. But whether or not that concept is an 'initial deviation from the truth', I hope here to show that for good or ill in Aristotle's system it 'turns out a giant at the end'.

(2) Let us then turn to the passage where Aristotle introduces this concept, at the beginning of *Physics* II 1:

'Of things that exist, some exist by nature and some through other causes. By nature there exist animals and their parts and plants and the simple bodies such as earth, fire, air and water. For these and similar things we say exist by nature. All these things manifestly differ from those not constituted by nature. For each of them has within itself a principle of change and stasis, some in respect of place, some in respect of growth and decline, some in respect of alteration. But a bed and a cloak and any similar kind of thing, so far as such a description holds of it, and to the extent that it exists through artifice, possesses no innate impulse of change. But so far as they happen to be made of stone or earth or mixtures of these, they possess such an impulse, and just to that extent. This suggests that nature is a principle and cause of change and stasis in the thing in which it primarily subsists, being in this thing of itself and not *per accidens*.' (192b8 - 23)

Now, apart from "nature", Aristotle recognises two other types of "cause": artifice, and "the spontaneous" (or coincidence).² The latter, which we might well hesitate to count as a cause at all (for

2. On this triple division of causes and its Platonic antecedents, see A. Mansion, *Introduction à la Physique Aristotélicienne* pp. 94 - 97.

reasons of which Aristotle was aware), receives no attention in this opening passage. The reason is simple: whether or not "the spontaneous" is rightly called a "cause", it is a secondary concept, defined in terms of the concurrence of causally independent factors, which factors have their causes either in human intention or in the nature of a natural substance. Assuming that in the present passage Aristotle is loosely using 'artifice' to cover all the cases in which a new state of affairs comes about as the intended result of human intervention in the natural course of events, we can say that he is here making an exhaustive dichotomy of the primary types of cause. However, the products of "artifice" in this wide sense that here most focus his attention, are artifacts in the ordinary sense, *i.e.* objects produced by skill. Although skill produces not only physical objects, such as beds and clothes, but conditions, such as the health of a sick person or the domestication of an animal, and activities such as dancing, Aristotle here fastens on artificial objects as providing him with the contrast he needs in order to explain his concept of "nature".

(3) That the products of "nature" and "artifice" form mutually exclusive classes, is a datum of common sense which Aristotle does not question. He does not for instance speculate here on possible reasons for regarding natural beings as the artifacts of some supernatural agent like Plato's Demiurgus. This accords with Aristotle's general insistence, evident in the *Physics* as elsewhere, that every type of enquiry be conducted in terms of concepts and methods appropriate to its subject matter, and confine itself to the questions that fall within its scope. Even if nature could be looked upon as an

artifact or system of artifacts (which Aristotle has good reason to hold that it cannot)³, such a point of view would lie outside the province of natural science. For the super-artificer himself, his purpose, and the "materials" he may be supposed to have used, are all, *ex hypothesi*, factors outwith the world of nature. It is not therefore to be expected that either the scientist or the philosopher seeking to clarify the concepts essential to science, should do otherwise than take it for granted that water and earth, animals and plants, are not artifacts; it not being their business to question this on theological grounds, any more than it is their business to discuss the Eleatic Theory 'that Being is one and motionless' (*Physics* I 2, 184b26 - 185a3).

(4) Leaving aside, then, the metaphysical possibility that human artificers are themselves (divine) artifacts and therefore similar or at least analogous to the artifacts which they themselves construct, we can say that the artifacts of ordinary experience differ radically from natural objects as regards both their causes and their power to cause other things. For artifacts are made by the skill of beings not artifacts like themselves, whereas natural beings come into existence only from other natural beings. Artifacts moreover are not in turn artificers, and nor do they need to be for further artifacts to be produced, whereas natural beings generated by other natural beings must in turn possess the power to generate others, since apart from natural beings themselves there is no source from which further

3. Cf. *Metaphysics* A 9, 991a20 - 23. Also *v.i.* Chapter II, paragraphs (4) and (27), and footnote 22.

natural beings could continue to come into existence. And if the production of natural beings depends not on the activity of an agent or agents outside the order of nature, but only on other natural beings, the same must be true of the changes necessarily involved in production. A new substance comes into existence through processes of change in substances already existing, and unless these changes can be accounted for from within the world of nature, the new substance itself cannot be so accounted for either. Thus the world of nature, unlike the "world" of artifacts, is self-contained as regards production and the changes necessary for production.

(5) It is plain then that natural substances collectively speaking contain within themselves a principle or principles of change. This follows from the self-sufficiency of the natural order to keep and have kept itself going. The concept of principles that are "inner" in this collective sense is quite uncontroversial, at least for any believer in the very possibility of science, *i.e.* in the possibility of explaining (in some sense of 'explain') natural phenomena in terms of natural phenomena. However, Aristotle's inner principles are also supposed by him to be "inner" in the stronger and by no means so obviously acceptable sense of "intrinsic to each individual substance". The notion of the self-sufficiency of nature as a whole appears to be quite compatible with the view that any change in any object results from the action of external factors happening to stand to that object in the appropriate spatial and temporal relations. On this view, the cause of change, in any given case, is as much external to the object changed as the artificer to the artifact. It is precisely this that Aristotle is denying when he speaks of an 'innate impulse' (ὄρμη)

of change; for if the impulse is innate, *i.e.* present in the object from its inception, then it is not imparted by anything external.

(6) We now have to consider in detail what sense can be given to the notion of an "innate impulse" of change. Aristotle apparently regards the phrase as requiring no special justification or analysis. On the common-sense level we no doubt often distinguish between changes in which the changing object seems to change "of itself" and those where the changing object appears inert and passive, itself contributing nothing to what happens to it. But this distinction remains unproblematic only so long as we ignore the fact that every change in nature depends to some extent on external conditions, even if only on the absence of what might obstruct the change. If every change is externally conditioned, then in what sense can any change be said to come specially "from within" the object?

(7) In attempting an account of Aristotle's concept of change from an inner principle, we shall find it useful to consider two limiting notions, namely (a) that of change entirely uninfluenced by conditions external to the object itself which changes; and (b) that of change entirely dependent on such conditions. I call these 'limiting' since each represents a conceptual extreme not coherently applicable to any change having place in a system of natural phenomena. A change fitting the first description would need to be either such as could occur under any external conditions whatever, or else caused by something which, as well as causing the change in question, also had absolute control of the external conditions so as to ensure that they are always disposed so as to make the change possible. On either alternative,

the change could be neither interrupted nor deflected. In other words, the cause of the change would be, in effect, omnipotent so far as this change is concerned. But this could be the case only if the change is not part of the system of natural events. For either there are no external conditions having any causal relevance to it (which would be true only if it is itself identical with the sum of events in nature, or alternatively forms an entirely separate system on its own); or else the change is caused by some being with supreme power to prevent any natural object from obstructing it.

(8) Suppose on the other hand an object whose changes were entirely shaped by external conditions. This implies that the object has no character or "nature" of its own either to determine or to limit what changes take place in it: indeed, the object is no more than a "place" of change, resembling the space of *e.g.* the *Timaeus* (and for that matter of Newtonian mechanics) in its total indifference as regards what can happen in it. (For Aristotle, not even space, or place, itself is like this, let alone substances.) If change were possible at all in a universe of such objects, then everything would change in the same way under the same conditions, since only the conditions determine change. But why should there be any change at all in such a universe? The objects as we have described them are of infinite potentiality. For there can be no property that any of them by its nature is excluded from possessing, since this would imply a limitation on the changes that they could undergo. In such a universe, then, an object can have any property logically compatible with its other properties at the time. Thus if a change occurs when certain conditions arise, it cannot be said to have occurred because, under

these new conditions, the object could not remain in the state it was in before, as for instance we say that wax cannot stay hard if heated beyond a certain point. It is logically true that if wax when heated softens then heated wax cannot stay hard; but there is no logical necessity (nor, in such a world, necessity of any other kind) for heated wax to soften. So why should it not remain hard? Moreover, objects lacking any character to determine their reactions to other beings can hardly be supposed to possess a character to determine the reactions of other objects to them. Therefore in such a universe nothing determines any specific change to happen that does happen, and there is nothing to explain why it should have happened.

(9) Aristotle proclaims his rejection of any such view of the actual world in *Physics* I 5:

'We must first lay it down that no existent thing is such that any chance thing can act on or be acted on by any chance thing, nor does any chance thing come to be from any chance thing, unless one describes the situation in accidental terms.'

By 'any chance thing' Aristotle means a thing such that its rôle in a given change situation might just as well have been filled by anything else. This is precisely what would be true of everything if nothing had any intrinsic character determining the changes it undergoes or produces. A given agent or patient can of course be described in terms denoting properties that are irrelevant ('accidental'), but there would not be an agent and patient acting and being acted upon unless they were also truly describable in terms of characteristics in which the causal relationship is grounded. Aristotle continues:

'For how could what is white come from what is cultured, except in the sense that being cultured might be accidentally conjoined with being not-white or black? Instead, what is white comes from what is not white,

and not from anything not white but from what is black or of an intermediate colour, and what is cultured comes from what is not cultured, but not from anything not cultured, but from the uncultured or some intermediate state.' (188a31 - b2)

At first sight Aristotle seems to be making a purely logical point, namely that the coming into being of X presupposes the prior absence or non-being of X. Thus it is incorrect (although not strictly speaking always false) to say that white comes into being from cultured, for being cultured does not mean or entail being non-white. If we are told that up to a certain moment something was cultured, and that after that moment it was white, we cannot infer that there was a change, since the statement is consistent with the presence of whiteness before the moment in question. However Aristotle is not only saying that the coming to be of white should be described in a way that makes it clear that the whiteness replaces its own prior absence. For white does not come from 'anything not white, but from what is black or of an intermediate colour'. Not everything of which 'not-white' holds true can give place to white: a geometrical point is not white but cannot come to be white. Thus the not-white from which white comes to be must be such that white can come to be from it; it must be an opposite or intermediate in the same range. And the range, we have seen, has a narrower field of application than the field within which 'not-white' could apply. Thus the patient or subject of the change to white is already more than a mere locus of change: it is such as to admit the range black - white: it has to this extent a character that marks off its kind from just everything else; and this differentiating characteristic is not the result of change, but its precondition.

(10) In paragraph (8) above it was argued that the concept of an object whose changes are in no way determined by a character of its own makes nonsense of any attempt to explain why any given change should occur. But it can also be shown that for Aristotle this concept would make nonsense of change itself, not only the explanation of change. Some of his predecessors had found change to be so paradoxical that they preferred to turn away from the study of nature (which, he implies, they would otherwise have pursued) rather than accept the paradox. Aristotle remarks on the lack of sophistication that led them into the difficulty, but he in no way suggests that having once been gripped by it, they were wrong to take it so seriously. From this we may assume that he regards it as a problem requiring to be solved before the concept of change can be accepted as sound and coherent. I shall now argue that his own solution depends on the very same conception of objects in nature as led him to say in the passage already quoted that not any chance thing acts on or is acted on by any chance thing.

- (11) 'The first investigators into the truth and nature of things were so to say diverted on to a different path, being forced back through their naïveté (ὕπὸ ἀπειρίας). They say that nothing that exists either comes into being or passes away, because it is necessary that what comes into being comes into being either out of being or out of not being, and yet from either of these it is impossible that it should do so. For that which is does not come into being, since it already is, and nothing could come into being from not being, since there must be some underlying subject.'
- (I 8, 191a24 - 31)⁴

The last phrase, 'there must be some underlying subject', is rather

4. Cf. *Physics* I 4, 187a26 - 29, 32 - 35; I 8, 191b31 - 33.

misleading. These words do not describe the difficulty as it presented itself to the earlier thinkers. The expression 'underlying subject' is Aristotle's own, not theirs, and the clause in which it occurs does not, as might first appear, pose one side of the ancient dilemma; on the contrary, it carries Aristotle's own solution.⁵ Yet the phrase is not entirely out of place in this brief account of the paradox, because it reflects a conceptual requirement to which the earlier thinkers were no less sensitive than Aristotle himself, although unlike him they could not see how it was to be reconciled with the fact of change. In expounding the problem we must begin by recasting the requirement that there be 'some underlying subject' in imprecise terms that will capture some of the original puzzlement. It was a nebulous thought that generated the difficulty, and once its vague bearings are distinguished and accurately articulated, the logical mystery of change vanishes, or so Aristotle believes. On the one hand, let us then say, if X comes into being, X could not have existed before, since X would then be nothing new in the world, and would not have come to be. But on the other hand it is impossible to accept that the X which comes into being was not somehow rooted in what went before: but in what? If we say: in things other than X, this leaves us no better off than if we had said: in nothing at all. For things other than X, whatever they are, are themselves, they are not X, and so for them to be themselves and

5. On this example of Aristotle's "reading his own doctrine into earlier systems", see H. Cherniss, *Aristotle's Criticism of Presocratic Philosophy*, pp. 53 ff.; F. Solmsen, *Aristotle's System of the Physical World*, pp. 81-82. On the general tendency see Cherniss, *op. cit.*, pp. 348, 354-355.

to exist there is no need for X. If there was a time when there were only things other than X, then X was no more present among them than it would have been present in a state of affairs in which nothing at all was the case. So if X comes into being but is at the same time rooted in what went before, it cannot have been rooted in nothing, nor in what was other than itself; so the only remaining possibility is in itself: but not in its own prior non-existence (for if this made sense, so would either of the two rejected possibilities); therefore in itself as previously existing. Thus it must have been before coming to be, and therefore did not come to be.

(12) From the very first, Aristotle tells us, this dilemma shaped attempts to philosophise about change and becoming. He himself as his own approach shows saw the paradox as defining a necessary adequacy-condition for any theory of change: whatever else a theory might offer, it must at least solve or dissolve the paradox. It is no accident, then, that those of Aristotle's predecessors who refused to draw the Eleatic conclusion that change and becoming are impossible, should have built their theories round the concept of opposites. (Even Parmenides described the "illusion" of becoming in terms of opposite poles.) For this concept seems to solve the problem. Let us consider how it might appear to do this. There are at least three conceptual advantages in equating X's coming into being with X's coming into being from the opposite of X, say A. Firstly, this permits us to say that before X came into being, there was not X, but its opposite. Secondly, what existed prior to X's coming into being, namely A, can be positively described as 'A', not merely as something

other than X, or as the absence of X, or as not-X. Thirdly, the positive description 'A' necessarily implies a reference to X, the opposite. For an opposite must necessarily be one of a pair; without one there could not be the other; thus A, even though it is not-X and is other than X, does require that X should exist in order to be A and exist itself. We ourselves are too acutely aware of the difference between logical and causal relations to find this convincing; but such would be the considerations that led those earlier thinkers to see contrariety or opposition as providing a middle way between the impossible alternatives whereby X must either come to be from what is already X, or from what is not-X and other than X and therefore devoid of any connection with X.

(13) Yet that very relationship between opposites that seems to undercut the dilemma also permits its reformulation in stronger terms than ever. If opposites of necessity exclude each other, so that each in itself seems to point to the other, they also exclude each other. One cannot be present when the other is, and from this point of view each depends on the other's not existing and continuing not to exist. How then can opposition begin to explain coming into existence? How can X come into existence from what is not only not X, but so alien to it that its own continuation even depends on there being no X? No reality can be so internally incoherent as to tend, of its own nature, towards its own non-existence; yet (as Aristotle points out in connection with the Platonists' account of change, *Physics* I 9, 191a19 - 22) this is exactly what coming to be would entail if opposite were generated out of opposite.⁶ If the thinkers who were content to

6. W.D. Ross, *Aristotle's Physics*, p. 23; Mansion, *op. cit.*, p. 276.

analyse coming to be in terms of opposites did not see this, it may partly have been because of the ambiguity of 'out of' (ἐκ). The distinction of meaning which concerns us here is between (a) the sense in which what X comes to be "out of" continues present in X when X has come to be; and (b) that in which what X comes to be "out of" is superseded when X has come to be. Let us call the first sense constitutive, the second non-constitutive. Further distinctions are possible within these senses, at any rate within the latter. The first sense corresponds to Aristotle's material cause, the second covers both the efficient cause and the opposite or contrary from which a change proceeds. Both the contrary and the efficient cause cease as such to exist when X has come to be and as such they are not present in X. In *Metaphysics* A 4, 985a10 ff., Aristotle comments on the weakness of his predecessors' grasp of the difference between material and efficient cause: that is, between the constitutive and one of the non-constitutive senses of 'out of'. But if these could be confused, so could the constitutive with the other non-constitutive sense, that which applies to the opposite superseded in change. Hence it may not have seemed so obvious that the coming to be of opposite X out of opposite A means the destruction of A in favour of X. A may seem still to be present as a constituent of X, so that despite the opposition there is continuity of existence.⁷ Better still if we can think of A itself as having come to be from an earlier X; for A then seems to have that X as its constituent, so it is no surprise if a new X comes to be from A: what more suitable material for the second X than that which is already made of the first?

7. Cf. *Physics* I 4, 187a31 ff.

(14) But this semblance of intelligibility vanishes on a clearer view of the ambiguities of 'out of'. There is then no ignoring the mutual exclusiveness of opposites, nor the impotence of this relation to solve unaided the original paradox. The only escape, Aristotle maintains (I 8, 191a23-24), is through his own analysis of becoming. This is more properly termed an analysis of the language of becoming,⁸ since the only evidence to which he appeals consists in 'what is said'. ('φάμεν', 189b32; 'φῶμεν', 190a4-5; 'λέγεται', 5-6; 'λέγομεν', 9). He means in effect to show that the ordinary conception revealed in ordinary modes of speech coherently satisfies both sides of the ancient dilemma. It is doubtful whether Aristotle would ever have raised the question of whether and how we can know that the thought-structures expressed in language reflect corresponding structures in reality itself. But it is fairly certain that even if he had framed this question, it would not have seemed to him the concern of the philosopher of science, whose task is to clarify the concepts necessary for science; which concepts are inevitably founded on the common-sense ones expressed in ordinary discourse.

(15) Aristotle's analysis begins as follows (I 7, 189b32-190b21): Sentences of the form '- becomes -' are of three types. In two of these what occurs on either side of the verb is a simple term; thus:

8. Cf. W. Wieland, 'Das Problem der Prinzipienforschung und die aristotelische Physik', *Kant-Studien* LII, 1960-1, pp. 206 ff., especially pp. 212-213 and 216-219 (translated as ch. 8 in *Articles on Aristotle*, vol. I, edd. Barnes, Schofield and Sorabji); B. Jones, 'Aristotle's Introduction of Matter', *Philosophical Review* LXXXIII, 1974, pp. 474 ff., especially pp. 476; 478. On the general approach, see G.E.L. Owen, 'Τίθεσθαι τὰ φαινόμενα', *Aristote et les Problèmes de la Méthode*, ed. S. Mansion, reprinted in *Aristotle*, ed. Moravcsik, pp. 167 ff.

(i) (A/The) man becomes cultured.

(ii) (A/The) uncultured becomes cultured.

In the third type what occurs on each side is a complex term:

(iii) (A/The) uncultured man becomes (a) cultured man.

These sentences are obviously descriptions of one and the same fact. This is a vital premiss of Aristotle's argument, although he does not enunciate it. Now sentence (ii) displays the fact that becoming involves replacement: the uncultured that becomes cultured cannot still be uncultured; nor can it already have been cultured: this is ruled out by the mutual exclusion of contraries. Sentence (iii) displays the fact that becoming involves an element that is present both before and after. The complex term 'uncultured man' represents a whole which is replaced as a whole by the whole corresponding to 'cultured man'. But these two wholes each have an element corresponding to 'man'. And man in one whole is not to be thought of as "replaced by" man in the other, since 'man' and 'man' are neither contradictory nor contrary terms. Sentence (i), on the other hand, displays neither replacement nor continuance. The terms on each side are not contraries, nor are they the same or the same in part. Yet the fact described by (i) is truly described by (ii) and (iii). We may draw two conclusions: (1) Becoming always involves each of the two aspects severally displayed by sentences of types (ii) and (iii), even though this may not always be apparent (as when the becoming is described by a sentence of type (i)). (2) The replacement aspect must be compatible with the continuance aspect, since the same fact can be described from either point of view.

(16) Let us sum up the position reached so far in Aristotle's own words:

'These distinctions drawn [*sc.* between sentences (i), (ii) and (iii)], one can see that in all cases of becoming, if we examine them in the way suggested, there must always be something that underlies, *viz.* that which becomes, and although this is numerically one it is not one in form. (By "one in form ($\epsilon\upsilon\delta\epsilon\iota$)" I mean the same as "one in formula ($\lambda\omicron\gamma\psi$)".) For it is not the same to be (a) man and to be uncultured. And one of these remains while the other does not remain. That which is not an opposite (*viz.* the man) remains, whereas the not-cultured and the uncultured does not remain, nor does that which is a combination of them both, *i.e.* the uncultured man.' (190a13 - 21)

Let us say that just as a sentence such as (i) above represents a fact, so the expressions occurring on the right-hand and left-hand sides of the verb in (i) represent components of this fact. Then just as sentences (ii) and (iii) represent the same fact as (i), but under different descriptions, so the left-hand and the right-hand sides of (ii) and (iii) represent the same components of this fact as the left- and right-hand sides of (i), but under different descriptions. Thus although 'uncultured' does not "remain", in the sense that it cannot coherently be added to the right-hand formula in any of the sentences, it does not follow that another description, *e.g.* 'man', of the same component does not "remain" (*i.e.* is coherently addible to the right-hand side), and in fact of course it does. Thus the same thing (component) "remains" under one description though not under the other. By the same reasoning, from the fact that 'man' "remains" it does not follow that another description, *e.g.* 'uncultured', also remains.

(17) This analysis is the basis for Aristotle's solution of the traditional paradox of becoming. It is not in itself the solution,

nor does he think that it is, as his order of presentation makes plain. After reaching the position just outlined and showing how it applies to various kinds of becoming illustrated by a variety of examples (I 7, 190a31 - 191a3), he then turns to the paradox and makes further distinctions in order to answer it (I 8, 191a23 - 191b27).⁹ As the Wicksteed - Cornford translation says, 'At this critical point of Aristotle's exposition, the text, as we have it, is elliptical almost to the point of unintelligibility'.¹⁰ I shall therefore offer a paraphrase. But it will help too if we first consider (not that Aristotle explicitly does this) how the above analysis cannot as it stands provide a solution. Now the analysis does succeed in showing how the same fact of becoming, and the same components of that fact, are and must be describable in different ways which between them reveal both the replacement and the continuity involved. No doubt vagueness concerning the distinction between difference of description and difference of things described contributed to the early thinkers' perplexity about becoming (and every other topic too, one would suppose). But even if they had fully grasped the distinction, they could still have put the paradox, as follows: We accept that sentences (i), (ii) and (iii) describe the same fact. But what a survey of these sentences shows is that this fact cannot be fully described

9. However the answer is partly anticipated at I 7, 190b18 - 19, 25 - 27. Cf. W. Charlton, *Aristotle's Physics I, II*, pp. 46 - 47.

10. Loeb text *Aristotle, The Physics*, vol. I, p. 83. Small wonder if Aristotle is "clumsy" here (the charge of Charlton, *op. cit.*, p. 80). Without technical vocabulary he must (a) make the distinction between what in the text I call appropriate and inappropriate descriptions; (b) differentiate between grammatical subject and complement of 'γίγνεσθαι' (either of which may be meant by 'τὸ γιγνόμενον'); (c) manage the different senses of 'ἐκ' (*v.s.* paragraph (13)); (d) (in my view, although not according to all interpretations) shift the scope of 'κατὰ συμβεβηκός' from subject to complement of 'γίγνεται' (*v.i.* note 11).

without absurdity. Take sentence (iii), '(A/The) uncultured man becomes (a) cultured man'. From this one can derive (ii): '(A/The) uncultured becomes cultured'. But one can also derive another sentence, (iv): (A/The) man becomes (something that is a) man'. Now (ii) and (iv) each represents one side of the original dilemma. On the one hand, something comes to be from its own opposite and its own absence, and we saw that this was unintelligible. On the other hand, something comes to be something it already is, and this is unintelligible as a description of becoming. All that Aristotle has done so far is to show that the paradox is by no means a *recherche* one which reveals itself only to those who abandon ordinary speech for some esoteric terminology. On the contrary, ordinary discourse shows it up in all its force; and while the ordinariness may explain why the man in the street is untroubled, since he naturally feels at home and secure in his modes of thinking, it cannot mitigate the objective problem itself; if anything the paradox is more unnerving than ever, now that it is so clearly seen to lie at the heart of our spontaneous untutored responses to our world. The philosopher who sees this will not stop at wondering how change is possible, for the incoherence of a notion so central to the human picture of the world casts doubt on all our claims to knowledge. Who could confidently assert even the Eleatic alternative once he has realised the extent to which we are constituted by nature to utter meaningless statements without suspicion of their meaninglessness? Who having seen this can be sure that he can acquire knowledge of anything?

(18) Thus in upholding the reality of change and becoming, Aristotle is also defending our title to consider ourselves potential knowers,

rather than beings incapable of registering reality except through meaningless responses to an unintelligible environment. But how does he escape this last formulation of the paradox? His answer (and here I paraphrase) is this. Different sentences may describe the same state of affairs; different terms may stand for the same thing. The sentences may all be true; the terms may all be true of their referent. And the sentences and terms are all meaningful, although their meanings differ. They each embody a "formula" (λόγος) or synthesis of "formulae", although not the same ones. But this does not entail that meaningful and true descriptions of the same state of affairs are all equally appropriate, or that they all equally reveal the structure of the fact. It may be true and meaningful to say that the physician builds a house, or the architect gives orders to the physician, but the fact described would be better portrayed by 'The builder builds a house' etc., even though the other statements are not false if the builder also happens to be a medical man. Seeming paradoxes result if we assume that every description is as appropriate as every other to the same fact. Thus the sentence 'The patient dictates a programme for his medical adviser' may be true, but if taken as the proper description it is paradoxical, since it contradicts what (by the very meaning of 'medical adviser' etc.) we take to be the normal and rational state of affairs. How can it be true when it conflicts with what is virtually an analytic proposition? There is no difficulty once we see that 'The patient dictates to the doctor' is not the appropriate description, but is true only because certain other sentences are unparadoxically true, *viz.* (1) The architect dictates a programme to the builder; (2) The builder is also the medical expert; (3) The architect is one of the medical expert's patients.

(19) To continue: There are appropriate and inappropriate descriptions of becoming. This is because the left-hand and right-hand sides of a 'becomes' sentence can be filled by appropriate and inappropriate descriptions. (By 'appropriate and inappropriate descriptions' here, I mean descriptions which are appropriate or not for the position assigned to them in the '- becomes -' matrix.) Now the term appropriate for the left-hand side is the one which in sentences of types (iii) and (iv) above appears on both sides. The term appropriate for the right-hand side is the one which appears on the right in sentences such as (ii) and (iii), replacing a contrary or contradictory term on the left. Thus the appropriate sentence for describing becoming is of the form of (i): '(A/The) man becomes cultured'. The paradox of becoming results if (a) we assume that all sentences give equally appropriate descriptions, while (b) implicitly acknowledging two principles already hinted at in the above remarks. These two principles are firstly, that that which "does the becoming", *i.e.* which corresponds to the grammatical subject, and whose description appears on the left, "remains"; and secondly, that that which the latter becomes (corresponding to the grammatical complement), whose description appears on the right, replaces something present before. If these principles are let loose on the assumption that all descriptions are equally appropriate, we get the following absurdities. (1) Since '(A/The) uncultured becomes cultured' is appropriate, it follows that the becoming process ends with something that is both cultured and uncultured (since what appears on the left in an appropriate description also remains). We then are forced to reason that what is supposed to remain does not do so in fact, since opposites would be true together; or else that opposites somehow are true together, perhaps because one manages to persist as the

"matter" of the other. (2) Since '(A/The) man becomes (something that is a) man' is appropriate, it follows that what does the becoming was both a man and not (something that was) a man before the change, since what is mentioned on the right in an appropriate description replaces its own opposite or contradictory. We have then to conclude either that nothing can really be replaced in becoming, since the presumed replacee (not-man) can only have been there to be replaced if the same being was both man and not-man; or else that there is replacement and the same being was both man and not-man.

(20) Such are the troubles kept at bay by Aristotle's conclusion that on the appropriate description ('κυρώς') what comes into being does not come to be out of not being: nor does what is come to be out of being (I 8, 191a35 - 191b27). As I read the passage,¹¹ Aristotle is here using 'out of' in the constitutive sense (v.s. paragraph (13)). The product of coming to be, say the cultured man, is a complex "made out of" (= whose continuing constituent is) a man (as a statue is made

11. Fortunately commentators agree on the main drift although not on details of interpretation. On top of the general obscurity there is a textual doubt at 191b20 - 21, although choice of reading here seems not to affect the main point of the argument. The interpretation I have chosen to expound in paragraph (20) assumes (pace Mansion, *op. cit.*, p. 76) that 'ἐκ' has the same (constitutive) meaning in both halves of Aristotle's reply: (i) 'ἡμεῖς δὲ καὶ αὐτοῦ φαμεν γίνεσθαι μηθὲν ἄπλως ἐκ μὴ ὄντος ... (ii) ὡσαύτως δὲ οὐδ' ἐξ ὄντος οὐδὲ τὸ ὄν γίνεσθαι' (191b13 ff. 'ἄπλως' or an equivalent should be supplied in (ii).) This entails that in the corresponding 'κατὰ συμβεβηκός' assertions the scope of 'κατὰ συμβεβηκός' shifts from the grammatical subject (in (i)) to the complement (in (ii)) of 'γύγνεται'. At 191b20 - 21 I would keep the MSS reading; the oddity of the example makes this the *lectio difficilior* as compared with Laas' emendation, and the latter yields a poor sense for the argument: witness the struggles of Ross, who adopts it (*op. cit.*, pp. 495 - 496) and Charlton (*op. cit.*, pp. 80 - 81; Charlton however seems less convinced of the MSS' wrongness).

out of bronze). In this sense of 'out of', that out of which is what I spoke of as "doing the becoming" (v.s. paragraph (19)), or as corresponding to the grammatical subject. So Aristotle is saying that what does the becoming should properly be described as what it was, is and will be before, through and after the change, *i.e.* as 'man', although it would not be false to describe it as not being what it will become, *i.e.* as 'not cultured'. And he is also saying that what does the becoming should properly be described as becoming what (as yet) it is not (cultured), although it would not be false to say that it comes to be what it is (a man; since what it comes to be is a certain sort of man - a cultured one). The wielders of the paradox obtained their weaponry by seizing on these not-false descriptions and treating them as best descriptions.

(21) We might ask: Has Aristotle any ground for his preference of descriptions of type (i), '(A/The man becomes cultured', aside from the fact that if these are classified as uniquely appropriate, the paradox cannot be sustained? If not, is he not begging the question in his own favour? Adherents of the paradox, if they were alert, could flatly deny the superiority of type-(i) descriptions; they might hold that types (ii) and (iv) are not merely as good but better, since they unlike (i) do not allow you to overlook the paradox, which after all is still there! But does Aristotle need to give a further reason for preferring type (i) once he has shown that the "phenomena" make sense if it is preferred, not otherwise?¹² If anybody is going to wait to have it proved to him that it makes most sense (in conceptual

12. Cf. *Eth. Nic.* VII 1, 1145b6-7, referred to by Owen, *op. cit.*, *Aristotle*, ed. Moravcsik, p. 173.

analysis as well as in science) to choose the account which itself makes most sense of the data, then his plight is not that of the early victims of the paradox whom Aristotle describes as students of nature *manqués*, 'turned back' by this obstacle. A hindrance exists only for those who desire some goal, and they, once the path is clear, do not require to be further persuaded of the rationality of taking that path.

(22) Yet Aristotle is not speaking only to would-be scientists waiting to be reassured that the language of becoming is logically coherent. His most attentive listeners have always included those whose principal concern has been to understand the very possibility of becoming itself. For them the discussion has only just started. What Aristotle has shown so far, on our exposition, is that whether or not becoming and change are possible in themselves, the concepts cannot be condemned as meaningless on the ground that they generate inconsistencies. But it is one thing to have it proved that a concept breaks no logical rules, and another to have it explained what must be the case if that concept has real application. No doubt in this instance we cannot help believing that it does; but then the question is: what must be the case for the world to be in this respect as we cannot help believing it? To give this question more of an edge, let us now focus on a problem which the argument so far has left completely unanswered.

(23) Granted that "something remains" on the analysis of becoming so far, how does this meet the paradox, when the paradox centres precisely on the fact that something is supposed to come into being

that was not in being before? For even if something can be shown to "remain", there must be something new too, or we should not be dealing with becoming. But if there was a problem in the first place how can there not be one still - not, perhaps, about everything that earlier seemed so puzzling, but at least about the nuclear requirement that there should be something whose presence replaces its own absence. And if this needs no solution, whether by comparing sentences of ordinary discourse or by some other means, then why was there a difficulty in the first place?

(24) The point may be put as follows. Aristotle's explicit analysis, as I understand it, is devoted to showing how something can be coherently said to remain the same through becoming without remaining the same in a way that makes nonsense of the becoming. More specifically, he shows how we can avoid having to use either 'The man becomes a man' or 'The uncultured becomes a cultured uncultured' as the proper descriptions. But this surely leaves unexplained how anything can become cultured from uncultured, or how a man can "become" anything but what he always was, a man. The difficulty is this. If the uncultured becomes cultured, then why should we not say that what 'cultured' stands for has come into being not having existed before? If there is no difficulty about this, then why was it so important to show that anything remained throughout? And how does it help to point out that what 'man' stands for remains throughout? This only means that there is no immediate difficulty with respect to 'man', since 'man' in this context does not represent anything that is supposed to appear where it previously was not. But it does not mean that there is no difficulty with respect to the new appearance of what

does newly appear, namely whatever corresponds to 'uncultured'. Now Aristotle will doubtless say that he has already given an answer, in stating in I 7, 190a15 - 16 and 190b24 - 25, that the man and the cultured are the same in number (the same individual) although not in formula. Therefore, he would say, it is false that what 'cultured' stands for suddenly appears in existence, since it stands for what 'man' also stands for, and this, it is agreed, was there all along. Now this answer could be made more sophisticated (*e.g.* by recasting in terms of the modern sense/reference distinction), but it seems to take care of the question. But it does not as it stands provide the *rationale* of the question's being taken care of in this way.

(25) Aristotle has not, in other words, explained why it is not legitimate to think of 'cultured' as referring to a new existent or thing. If it were, then 'uncultured' presumably would refer to a past existent. The uncultured would be a thing that no longer exists, the cultured would have started to exist. The cultured man who comes to be according to sentences of type (iii) would be a conjunction of two existents: a man, present all along, newly joined by a cultured appearing where previously it was not. The becoming of the cultured, then, is really a becoming out of nothing, for what 'cultured' applies to is not identical with anything that existed before 'cultured' acquired a hold in the world. Since the man now is a separate thing from the cultured, the fact that the man pre-existed does not soften the *ex nihilo* arrival of the cultured. But once the problem is set out in this way, it answers itself (as doubtless Aristotle expected it to). We have to regard 'cultured' as true of something that pre-existed, otherwise the cultured is a thing that comes from nothing.

'Cultured' therefore has to be true of something, X, of which something else was also true (since otherwise X would have had no character, hence have been nothing at all, before 'cultured' became true of it). Presumably 'uncultured' was true of X before 'cultured' was. But that which 'cultured' is now true of, and which existed before, cannot simply be identified as that of which 'uncultured' was previously true. For that too would mean that 'cultured' came to hold of something in itself characterless, which existed through the replacement of 'uncultured' by 'cultured' but without fulfilling any one description of its own during this change-over. The X, then, to which 'cultured' now applies must be describable by some such term as 'man', which was true of it even when 'uncultured' was true.

(26) But now if the difficulty seems to have evaporated of the cultured coming into being where previously it was not, this is because the cultured is no longer being regarded as a separate existent from the man. But still, when 'cultured' comes to apply, something new happens, only not the sudden emergence of a new thing. We have to say that what 'cultured' imports when it starts to apply is not nothing at all, but not a thing either, in other words, a property of a thing, whether quality, quantity, relation or whatever, so long as its category is not that of things or substances. And the difference that is now being driven home between things, and properties in other categories, is that the new appearance of the latter where previously they were lacking is not the paradox of 'something out of nothing' that it would be if such properties were things in their own right. Thus the distinction between things and properties furnishes us with an answer against those who accuse becoming of entailing '*fieri ex nihilo*'. We

can now say that in every change there is a genuine something, which does not come to be in that change (so that for it the problem does not arise), and in every change there is also what is not really some thing at all, so that although it does come to be where previously it was not, the problem does not apply to it either.

(27) We have seen that the subject X underlying first the absence then the presence of culture must be characterisable; otherwise it could as well be nothing at all. Aristotle's analysis of the ordinary language 'becoming' sentences bore out this metaphysical point, since he proved on this level that "something remains" by pointing to the recurrence of the same general term 'man' on either side of the verb in (iii). But it is not enough to say that X must be characterisable by a general term. For the characteristic corresponding to this term must be such that by its very nature it imports, whenever it is instantiated, the individual substance in which to be instantiated. This is perhaps more easily understood by contrast with characteristics corresponding to terms such as 'cultured'. These must be such as not to import of themselves the individuals to which they apply; for they necessarily apply to individuals already constituted and set up: otherwise change is absurd, implying a new existent for every new property. Let us call the former type of characteristic 'substance-constitutive'; by this we mean both that the individual possessed of such a characteristic is thereby constituted a substance of the sort that it is, and also that the characteristic itself has to take care, on its own behalf so to speak, of the realisation of its instances, since unlike non-substantial characteristics, it cannot rely on there being pre-constituted individuals to receive it. It is now clear that

the possibility of change and becoming depends upon the metaphysical distinction between things and properties that are not things, and hence also on the distinction between substance-constitutive properties and others. And these distinctions will have to be treated as absolute, unless we are willing to concede (as Aristotle emphatically would not) that from some points of view becoming is metaphysically possible, from others not, and that none of these viewpoints is objectively superior to the others.¹³

(28) Does our experience or our language, or both, enable us to give content to this distinction between the two types of properties by identifying specific instances as falling on one side or the other? If not, then although change may still be possible, it will not be something of which we can have specific knowledge. We shall be entitled to describe successions of phenomena, or replacements, but not changes with a subject that "remains". Specific substances too will be unknowable as such if they are characterised only by properties whose substance-constitutive power is undetectable by us. Thus since Aristotle is concerned with human knowledge of becoming, his theory now depends upon the possibility of our actually distinguishing among knowable characteristics the substance-constitutive ones from the rest. We must in other words be able, as he believes that he is, to fill in the doctrine of the Categories by giving correct examples, and especially examples in the category of Substance. So now the question is whether there is any principle on which such a division may be

13. See Appendix to Chapter I.

made?¹⁴ If not then his account of becoming remains a mere schema, such that we could never say for certain what if anything in the empirical world counts as a case of becoming (fits the schema). Two possible candidates for a principle of division suggest themselves. One concerns the temporal durations of characteristics, the other their causal properties.

(29) The relative lengths of time during which characteristics are instantiated in any given situation clearly plays some part in our allotting to one characteristic (or set of them) the status of substance-constitutive and not to others. After all, the way in which 'man' was originally distinguished as to its function from 'uncultured' and 'cultured' in the original example was by reference to the fact that the former does, the latter do not, continue to hold on each side of the change, and through it too if it takes time. But equally clearly, remaining instantiated for longer (in a given situation) supplies at most a necessary condition for substance-constitutivity. Not every continuing characteristic has or could have this status. (Suppose for instance that the man who became cultured was all the time in Athens.) There must be some difference other than degree of duration between the substance-constitutive property and the other properties present in a given case: for Aristotle, a non-substantial

14. The problem is not merely to find a formal criterion (such *e.g.* as the complex one offered by D. Wiggins, *Identity and Spatio-temporal Continuity*, pp. 27 ff.), but to see whether anything about the content of a general term tells us that it expresses a substance-constitutive characteristic or not (and hence whether or not it fits the formal criterion, supposing a satisfactory one to have been found. As for this last question, it is not clear to me how Wiggins could demonstrate that 'triangular' does not satisfy his set of conditions for a substance-term.)

property could not conceivably get to be in the category of Substance by continuing to apply for longer. Moreover the difference must be one that applies in the same way to all cases; that is to say, for Aristotle, a substance-constitutive property is such whenever it occurs. Although the concept of substance has been developed in close connection with that of subject of a given change, being a particular substance, and being a substance of a given kind, is not relative to a given change-situation. If the man in the original example is as such a substance, then he is so in all changes, and all men are so in all changes. Thus substance-constitutivity cannot be equated with longer duration, for a property whose presence is relatively permanent in one instance may be relatively impermanent in another.

(30) 'All men by nature desire to know.' The opening remark of the *Metaphysics* throws some light on the question of what more adequate type of principle might be found to support the distinction between substance-constitutive characteristics and others. For whereas all predicates that apply to the subject of change throughout the change are equally true, they are by no means on a par as regards the information they convey. This being so, it is reasonable to suppose that when someone reports a change in order to pass information, he will naturally use a more rather than less informative description under which to present the subject, unless there is some reason for not doing so. So far this is merely a descriptive generalisation concerning human linguistic behaviour. Suppose, however, that we recast the observation in the normative mode, and maintain that the seeking and acquiring of knowledge are the highest human activities (or, the highest whose results can be expressed in language). Now we have a

basis for also maintaining that the more informative description is that in terms of which the subject ought, most properly, to be described. If, moreover, among information-rich descriptions there are some that convey information of an especially esteemed kind (for example concerning the object's impersonal relations to other objects, as opposed to its emotional effect on the speaker himself), then descriptions of this type will for this reason too be assigned priority by whoever values this type of information. It is, perhaps, not difficult to see how such a normative attitude could present itself to its holder in the form of a metaphysical doctrine of substance-constitutive characteristics, or essences.

(31) Thus if something equally truly describable as 'a human being', 'a pale object', 'something in Athens', 'something weighing ten stone', is said to become, say hot, Aristotle's preference for describing this subject primarily as 'a human being' can be justified as follows: the first description on the list tacitly connects the subject, thus described, to the change that is predicated, in a way in which none of the later descriptions do. The sense in which this is true will be thoroughly obscured if (like Hume) we approach the matter believing that a "connection", to deserve the name, must either be necessary or rationally intelligible or both. By these standards, 'human' no more provides a connection than the other predicate-expressions. The point is, rather, that for a language user of normal experience, the first description provides some indication, however sketchy and incomplete, concerning various possible circumstances under which, and processes by which, the change is likely to have taken place, as well as concerning possible conditions for reversing the change; whereas the

other descriptions, again for someone of normal experience, in themselves provide no such information. The description of something as 'white', 'cylindrical', 'ten stone in weight', or 'in Athens' by itself excludes no possibilities whatever concerning the ways in which the object so described might change, or the conditions under which a given change might occur or fail to occur or be reversed.

These blanks only begin to be filled in if we are also told what else is true of the thing so described: whether it is a block of limestone, an animal, a roll of linen, etc. It is to be noted that this way of distinguishing substance-constitutive characteristics does not (at any rate on this initial level) depend on any conception of causation as involving empirically unknowable "powers". We are speaking of causal relations as they figure in ordinary experience, and whether or not they can only be explained by reference to "powers", we are concerned here not with their possible explanation but with their manifestation in regularities. Different particular things to which 'man' truly applies behave in more or less the same way under the same conditions, whereas different things to which 'white' and 'triangular' truly apply will behave utterly differently under the same conditions, the behaviour varying according to what else is true of the white or triangular object in each particular case.

(32) The remarks of the preceding paragraph do not as they stand offer an unexceptionable criterion for picking out terms for substance-constitutive characteristics. They indicate the area in which such a criterion (if possible at all) might be found. The area is that of descriptions the use of any one of which, in reference to a particular subject, would furnish someone of ordinary experience with some

information, however rough, concerning the causal processes by which a given change comes about in the subject so described. (It is to be noted that the class of these descriptions is narrower than that of causal terms in general, since there are many causal terms, *e.g.* 'magnetic', 'poisonous', which denote kinds of changes that their subjects are likely to produce in other beings, and give no information about changes in the subjects themselves.) It cannot be automatically claimed that any description meeting the condition just mentioned is a term for a substance-constitutive characteristic. This conclusion could be drawn only if it had first been shown that no description representing what we should naturally regard as an acquired characteristic (*i.e.* belonging, when it belongs, to an already constituted individual substance) could meet the above condition. But this seems unlikely to be true. Therefore the class of substance-constitutive descriptions is only a sub-class of those mentioned, and it is not clear what the differentia of this sub-class would be.

(33) But enough, I hope, has been said to show that there is, in ordinary usage, a basis for distinguishing substance-constitutive characteristics from *per accidens* ones. The structure of ordinary thought therefore not only justifies Aristotle's analysis of change as requiring a continuing subject, but also provides an anchor for the metaphysical distinction between types of characteristic on which this account depends. Thus the argument undertaken in paragraph (10) is now complete. There it was claimed that the idea of a universe of things lacking all causal characteristics not only rules out any explanation of change, but makes nonsense of the notion of change as

happening at all. This claim has now been shown to follow as a conclusion from the premiss common both to Aristotle and his predecessors, that change makes sense only if "something remains". The latter vague notion was articulated by means of the concept of an "underlying subject", and this in turn was found to depend on the distinction between substances and attributes, and therefore on the distinction between substance-constitutive characteristics and others. We have now seen that the former type of characteristic is marked off by its causal content, the causality relating to change and stasis in the substance thus characterised. In this way the main topic of *Physics* I is related to that of II, where the subject of discussion is the "nature" of a thing as its "inner principle of change". Aristotle himself underlines the connection when he says near the beginning of II 1: 'Nature then is what we have said. All things have a nature that have such a principle, and these things are all substances. For each is a subject, and a nature is always in a subject.' (192b32 - 34) Subjects of change are such as to behave as they do. Thus the behaviour is never a function of external conditions alone. All change then is at least partially determined by the subject itself, and in this sense there must be "inner principles of change" if there is to be change at all.

(34) But we now have to consider another and less obviously justifiable sense in which Aristotle holds a nature to be the inner principle of change. To elucidate this let us revert to his comparison of nature with artifice. He initially compares them in order to stress a contrast, but the very terms of the contrast betray his sense of fundamental analogy. A natural substance differs from an artifact in

that the latter does not have an inner principle of change and stasis: it is developed and then manipulated (caused to "behave") by another being, artificer or user. But the contrast is not simply between natural substances and artifacts, for this difference is equally a reason for contrasting natural substances with artificers. The artificer, unlike the natural substance, brings about (*qua* artificer) change in something other than himself. Now in both wings of the comparison, the contrast between nature and art impresses Aristotle precisely because in his view (as his subsequent discussion will show) the two cases are otherwise so much alike. As artificer stands to the artificially induced change, so natural substance stands to natural change, except that in the former case the source and the subject of change are different, save *per accidens*, while in the latter they are necessarily the same. In putting the matter thus I may seem to underestimate what we shall see is an essential difference, but I mean only to display it against the background of equally essential analogy. Now following the analogy, we find that a natural substance gives rise to change from "within" itself not merely in the sense that it, being the kind of thing that it is, helps to determine the changes occurring in it, so that under the same conditions it would change in a different way from a substance of some other kind. For the craftsman (as we ordinarily view such a one) is causally autonomous as regards his craftsmanly activities, in the following sense: he dictates from within the shape and pattern of the changes he brings about and the objects or new situations he thereby produces. Although he adapts his activity to the particular circumstances, still the way in which they are allowed to influence the pattern of production is determined by his objective. They play no part in shaping the overall form of the change, being themselves harnessed to help realise an already

determined form. What kind of change it is that takes place depends on the craftsman, his skill and his purpose, and the external conditions under which it does take place are relevant only insofar as they make possible that kind of change; they do not contribute to determining what change it is that occurs when they make it possible.¹⁵

(35) In parallel with this, the nature of a natural substance, as Aristotle conceives it, does not simply make some causal contribution to the character of its changes (which was shown to be a necessary consequence of the very notion of a subject of change) but in the primary and central type of case it wholly determines the pattern of change. If we may extend from substances to changes Aristotle's own distinction between what something is and the fact that it is, we can say that a natural substance is causally independent of external conditions as regards the determination of the whatness of the change, although dependent as regards its actual occurrence at a given time and place. Just so, the character of a particular existing substance is not a function of its surroundings, although it totally depends on their favour for the fact that being what it is, it exists. Now on this view of natural change, not all changes that occur in a natural substance are determined as to their character from within the substance, any more than every change that might occur in the sculptor's stone as he works is dictated by his purpose with it. If rain happens to drench it, any effect that this might have on the stone lies outside his intended effect, and may interrupt and hinder the change he is in process of producing. Similarly with a natural substance. Given

15. Cf. A.P.D. Mourelatos, 'Aristotle's "Powers" and Modern Empiricism', *Ratio* IX, 1967, pp. 97 ff.

that the growth of a sapling is the change of which its nature is the "inner principle", if the sapling burns down, this is no part of the behaviour that it was its nature to display. We may be tempted to deny this on the ground that the conditions under which it peacefully grew are of one sort, while those under which it catches fire and burns are quite different, and we would not expect it necessarily to behave in the same way when the circumstances have radically altered. Aristotle would not disagree; but nor would he draw what to us is the obvious conclusion that the object's nature fits it for both types of change, and that under different circumstances the same woody character is differently but equally displayed in variety of reaction. For Aristotle, this would be as absurd as arguing that since the builder would not expect a roof necessarily to withstand hurricane conditions, therefore his purpose in building is as much, though differently, expressed in its blowing off as its staying on.

(36) We may sum up the last point as follows. If the nature of a natural substance is exhibited in the changes whose character it autonomously determines, then in these changes the only rôle left to the external conditions is that of permitting the change or not hindering it. It follows that if the conditions do hinder it, the resulting situation, whether it is a new change or a quiescent state, does not exhibit the nature of the substance. Although the new situation may come about through natural processes as opposed to human interference, it is no more natural to the substance concerned than if it were the product of artifice. It is "by nature" without being natural to its subject: as Aristotle says, it is "enforced".¹⁶

16. Cf. D.D. Heath, 'On some Misconceptions of Aristotle's Doctrine

(37) There is no doubt that ordinary experience affords plenty of examples that seemingly illustrate this conception of nature as an autonomous inner principle. Many if not most of the objects that attract our unreflective practical and aesthetic attention regularly exhibit patterns of change against a physical background which itself shows no corresponding isomorphic configuration either dynamic or static. A stone falls, an animal jumps, a plant blossoms under conditions in which perhaps no external change at all occurs, or none that keeps in phase with the changes mentioned. Water may follow the line of its banks, but equally often it simply falls - through the air, not channelled by it. What more understandable than that a virtual pioneer in the philosophy of nature should suppose that the natures of things are to be read off from such changes alone, and that all other reactions are to be consigned to the category of the 'incidental', as reflecting nothing intrinsic in the objects that suffer them, but only the tendency of the interfering agent? What more natural than to adopt (or fail to shake off) the ever-alluring analogy with the human purposeful agent? But the fact that a notion has many illustrations does not entail that it is a coherent concept, or has any actual instances, and we may well doubt the sense, as well as the scientific usefulness, of a view that obliges us to identify the changes that are natural to a given object with a mere sub-class of those that occur in it through perfectly natural causes. Aristotle himself would dismiss as fanciful the attribution of intention and intelligence to

on Causation and τὸ αὐτόματον', *Journal of Philology* VII, 1897, p. 111: 'Aristotle's system ... slurred over the consideration of natural inter-action, very commonly ranking it as something antagonistic to the natural order, βύαιον; and ... tended to reduce the course of Nature to a series of self-developments of almost independent organisms.'

plants and animals; but is not the attribution of "natures" in the sense explained a similar mistake: one, moreover, that loses its *rationale* once we cease to regard all natural substances as purposeful agents?

(38) The two "mistakes" are not on a level however. Aristotle saw as clearly as any modern scientist that to interpret animal and plant behaviour as intelligently purposeful explains nothing that could not, as he thought, be well explained without it; whereas to deny "natures" and natural changes would for him be tantamount to denying the very possibility of all explanation. This concept is the starting point for any philosophy of nature, and so it is that at II 1, 193a1 - 9 he writes:

'What nature is has been stated ... But that nature exists it would be ludicrous to try to prove. For it is evident that there are in the world many such things, *i.e.* things endowed with "natures" in the sense explained. And to prove what is evident by means of what is not evident betrays an inability to discriminate between what is and is not in itself knowable. It is obvious that a person can be in this state: someone blind from birth might reason concerning colours. What this amounts to is that such people can only be arguing about words, without any meaning in mind.'

Aristotle does not of course mean that a normally constituted human being "perceives" natures as he perceives colour. This might be the case with change, but a "nature" is a principle of change, and our recognition of principles, by Aristotle's own showing, comes from reflection upon experience: if they were sensory "givens", they could not function as principles. We start with 'confused things, which to us are initially more obvious and clear', whereas 'the elements and principles become known later from these upon analysis'. (I 1, 184a10 - 26). The comparison with the blind man makes the point that

people can try to reason while lacking any conception of what they are reasoning about, and this lack of understanding shows itself in the very fact that they try to reason: whether the subject matter is such that it can only be grasped through the senses, or (like the fact that there are "natures") whether it provides the necessary starting point for any relevant investigation. The philosopher of nature must presuppose the reality of the physical world, the existence of change, and finally the actual part played by "natures", in Aristotle's sense as inner principles of change.

(39) Unfortunately Aristotle does not distinguish between the ludicrous activity of proving what is too fundamental for proof, and the far from ludicrous activity of moving, by reflection, to an articulated understanding of the assumption too fundamental for proof. He himself indulges in this second activity when in *Physics* I 2 he argues against the Eleatic denial of plurality, or in *Metaphysics* I shows how even the denial of the law of non-contradiction involves at the same time its acceptance. But so far as the existence of "natures" is concerned, he proceeds as if the case is indeed like that of colours for a sighted person: such a one not only knows of their existence without proof, but cannot even conceive that he could question it. The reason for this may be dialectical: unlike plurality and the law of non-contradiction, no one had ever challenged (except by implication, as a consequence of these two challenges) the Aristotelian concept of "nature" and its applicability to the real world. And the reason for that is surely that Aristotle himself was the first to articulate this concept. Now in his arguments against Parmenides, and in part of his argument concerning contradiction, Aristotle relies

on his own doctrine of substance and the categories as an unassailable point of departure. We shall now see that this also provides a rational basis for the Aristotelian theory of "natures as inner principles of change".

(40) Four assumptions make up the grounds of the theory. The first is that there are substances in the sense explained in the *Categories*. Secondly, we discover what it is for something to be a natural substance of a given kind by observing the regular behaviour of substances of this kind. There is no other path to knowledge of the "natures of things". Thirdly, there are irreducibly different kinds or species of substance. Fourthly, a substantial essence is unitary and conveyed in definition by a unitary formula. From these premisses it follows that a substance of a given sort must exhibit its nature, or what it is, through change that is specific to that sort and also in some sense unitary. If observable changes in natural objects cannot be construed as specific and unitary, this would show, so far as empirical evidence can decide such a question, that the Aristotelian concept of substance lacks application in the physical world. Now the main problem turns on the type of unity that a change must display in order to be seen as expressing a substance. From our previous discussion it is clear that for Aristotle unity of change means in effect change in accordance with a single pattern, whether the pattern is immediately discernible to the senses, like the typical lines of ascent and descent of "simple substances" such as fire and earth, or whether it can only be made out by repeated experience and the marshalling of many observations, like the complex and far more abstract pattern of a living creature's life-cycle. It is this conception of the unity of a substance-expressing

change that leads him to hold that any change which diverges from some single typical tendency in a given direction represents nothing but interference: not merely with the "natural" change itself, but with our one source of knowledge about the substantial nature concerned.

(41) Such a view has momentous consequences for scientific practice. It is notorious that 'with very few exceptions, the Ancient Greeks throughout a period of eight hundred years made no attempt at systematic experimentation'.¹⁷ So writes Professor Sambursky. No doubt there were many contributing causes, sociological, psychological, ethical, religious.¹⁸ But to these we may add the metaphysical notion of nature as an inner principle of change - for if Aristotle first articulated this concept, he did not create it *ex nihilo*; it had its roots in earlier philosophy, if not also in common sense. Once it is supposed that a natural substance manifests its nature through some single typifying pattern of change to which external circumstances contribute nothing but the opportunity of realisation, two things follow. Firstly, posing and answering questions of the form 'How will it behave under such and such (positively specified) conditions?' adds nothing to a scientific understanding of the substance. To see this we need only divide the conditions of its existence into those kinds which favour the occurrence of the "innerly determined" typifying change, and those which suppress or interfere with it. The favouring conditions do not reveal the character of the substance; they only enable it to reveal itself in autonomous behaviour. Given

17. *The Physical World of the Greeks*, p. 2.

18. See Sambursky, *op. cit.*, ch. X.

that typifying behaviour T occurs in a substance S under conditions C, it is incorrect to say that S is such as to exhibit T under conditions C. For according to the supposition, S is such as to exhibit T *simpliciter*. Conditions C are those under which this typifying change is not prevented and therefore occurs; but from this it does not follow that S is typified by exhibiting T-under-C. Now consider the conditions that prevent the occurrence of T. These are evidently powerless to reveal the character of S, since they preclude the only kind of behaviour in which this character shows itself. The second point is more narrowly relevant to the question of experimental method, since it centres on the artificial control of conditions. It is Aristotle's view that substance-typifying changes are as a rule successfully realised in the natural environment. Most of the conditions in which most individual natural substances find themselves are such as to permit their typifying behaviour, or at least most of the time. It is therefore senseless to place a substance under artificial conditions for better observation. This cannot enable us to identify the typifying behaviour in a given case; nor, if we believe that we have identified it, can it help us to study it better. For if the substance still exhibits the behaviour in question this teaches us no more about its nature than we could have learned through observing it in the natural context. But the artificial conditions are more likely than not to inhibit the typifying behaviour, and in that case we learn nothing at all about the substantial nature, since this is revealed only through changes that are not taking place. Experiment in short opens up no new access to the facts, and may succeed only in suppressing them. It follows that the only rational attitude for the natural scientist is that which Sambursky calls 'submissiveness' to the world of nature; for natural substances best

"tell us" what they are when as spectators we leave them to themselves to operate under their own direction.¹⁹

(42) But it is surely a crude mistake to think that an object's unitary nature is manifested only/behaviour of a single observable pattern. Surely it is more scientific and intellectually satisfying to construe the empirical data on the assumption that an underlying unity runs through all the object's behaviors, whether in usual, unusual, natural or artificial surroundings. Seen thus, all its actions and reactions equally tell us what it is; all are equally natural to it; none is a divergence or interruption except from the subjective standpoint of some human purpose, as when we say that a machine has broken down, well knowing that it is of a nature to react to current conditions in the way that unfits it for use. For the same lays by which it worked also make it stop working, so that in this sense what it does and how it is is always the same, *i.e.* an expression of the same set of laws, the differences being due to shifts in values of the same variables. Our faith in this attitude has been justified by the actual success of sciences such as mechanics and molecular chemistry. To understand Aristotle's blindness to the very possibility of such an approach, let us briefly consider certain aspects of these two sciences.

(43) In mechanics, it has often been pointed out, there is no place for the concept of specifically different substances. All bodies can

19. See *ibid.*, pp. 234 - 235 for an excellent statement of the conclusion, although without the metaphysical premisses.

be shown to behave at all times in accordance with the same set of laws, because the laws depend on the properties of body as such. These properties, moreover, according to Aristotle's categorial scheme, fall into categories other than that of Substance: mass, velocity, position, duration, etc. The same individual Aristotelian substance could alter in respect of all these without impairment to its substantial nature. Thus mechanics studies, through their effects, the "natures" of these properties in their determinations and combinations. But in a mechanical account of an object's behaviour, none of that behaviour can appear as issuing from a specific substantial nature. Thus if the fall of a stone and the rise of vapour are explained mechanically, we can no longer say that these motions typify these substances (earth and air) as such. But if the stone's substantial nature does not determine what seems its most obviously characteristic behaviour, we are in a poor position to claim that it determines any of the stone's behaviour; thus substances as such are metaphysically "inert" and hence unknowable, since knowledge could only ever have come to us through their actions.

(44) With chemistry the situation is rather different. It is true that Aristotle's refusal to follow Plato's mathematicising lead in the study of nature cuts him off from the basic concepts of physics and chemistry alike. Many writers have dwelt on this point, and I have nothing to add to their expositions. However, chemistry unlike mechanics does deal with specifically different substances (elements and compounds). Now the unity of the chemical behaviour of any one of these is grounded on the conceptual unity of the molecular and atomic theory. This theory postulates for each type of substance a

structure which is the starting point for explaining observed interactions with other types, in accordance with a few principles. Thus in chemistry as we know it, the structuredness of chemical matter is regarded as a necessary given, although it is an empirical question what particular structures should be assigned to given types of substance so as best to explain the phenomena. Now Aristotle by contrast with Plato does not regard structure in the natural world as inexplicable from within the natural world itself, being the product and sign of some metaphysical interface between physical existence and a transnatural order. But at the same time Aristotle does not take structure as given in any individual case: rather, it is what the individual natural substance by natural processes achieves. This means that in Aristotle the conception of empirically knowable structure has to be supplemented by another notion of order, that of the orderly progression of a natural substance towards the full development of the empirically knowable structure. The progression is described by reference to the structure, as tending towards it; and it cannot also be described by reference to other already existing empirical structures, for this would be to substitute the notion of structure as given for the notion of structure as achieved. Aristotle in common with Plato assigns to empirically knowable structure an empirically unknowable source, but with a difference: Plato's is the form beyond the world, while Aristotle's is the power of the natural substance to attain structure. This power is in the physical world, being centred in a particular natural substance, but it cannot be identified in its own right with any actual set of empirically knowable structures or properties. Thus Aristotle like the modern chemist would account for an object's behaviour by reference to its structure - except that for Aristotle the structure is the final

terminus of change, not its precondition. In consequence, Aristotle cannot hold that the nature of a substance is impartially typified by all its changes under whatever conditions, for there is only one type of change that depends on the specific structure, namely that which results in the latter's full development. Aristotle is therefore forced by his own fundamental concepts to identify the behaviour that manifests substantial nature with a mere sub-class of all the behaviors of which the substance in question is physically capable.²⁰

(45) Thus Aristotle's notion of "natures" as inner autonomous shapers of change is not to be put down to a naive projection of the concept of conscious intentional activity. It is his metaphysic of substance that dictates the idea of "nature", including just those features that so obviously invite comparison with "artifice". We shall return to this comparison, since we have not yet examined what for Aristotle, despite their resemblance, is the fundamental and decisive difference. First however let me state two corollaries of the position reached so far. In the first place, the distinction between changes that are "natural" in the sense explained and those which are not is as absolute as the distinction between the *per se* unity of a substantial form such as that represented by 'man', and the *per accidens* unity of a complex such as that represented by 'white man'. Secondly, natural change is ontologically and conceptually prior to all other types of change. All other changes either inhibit, interrupt or modify natural change, or else represent the conjunction

20. Cf. Mourelatos, *op. cit.*, pp. 102 - 103, who argues on rather different grounds from mine that Aristotle does not simply 'fail' to refer dispositional properties to micro-structural bases, but rejects *a priori* any such attempt at explanation.

of several natural changes. And in tracing back the causal history of any such non-natural change, one will always reach a natural one from which the process started. Individual substances A and B come into contact, and A causes a counter-natural change in B. But either A came into contact through pursuing some natural change-pattern of its own, or it was brought by some other substance C. And if the latter, the change that brought A under the influence of C is either natural or not, and if the latter, the same argument can be repeated. But at some point we arrive at a natural change and an originating substance that changes "of itself", and what makes this certain is not any vague finitist distaste for infinite regression as such, but the following quite precise reason: If no change were natural, then substances would never as such express themselves through change. The concept of "substance" would then contribute nothing at all to an account of the natural world, nor therefore to a metaphysics intended to subserve science.

(46) So far in this chapter we have examined two senses in which a thing's nature is an "inner principle of change". To attribute a nature in the first sense, is to say that the thing in question has an intrinsic character that makes some contribution to determining the sorts of changes that take place in it. The relevant contrast here is with a featureless somewhat which is a mere locus of change but which lacks any character to limit the changes possible to it, so that any change would be totally determined from without. In rejecting this, Aristotle has the clear support of ordinary thought as reflected in ordinary usage. With the second sense of "inner principle of change" the support is not so clear, although even here

Aristotle is by no means obviously at odds with ordinary thought. In this sense, a substance, being of a certain nature, is self-sufficient to determine the pattern of its typical changes, the external conditions playing no part in shaping what happens, but only providing the background in which it can happen. Here the contrast is with the substances of modern chemistry and the corporeal particles of classical mechanics, all of whose actions and reactions are co-determined by the character and properties of the objects themselves together with those of their environment. Now in both the above senses, the "inner"/"outer" contrast opposes determination of change by the substance itself with determination by external conditions or substances. We have now to consider a third sense in which Aristotle holds the nature of a thing to be an "inner principle of change".

(47) In this third sense, the implied contrast is not between determinants but subjects of change. It is from this point of view that Aristotle draws a distinction between nature and artifice which for him is no less fundamental than the analogy discussed earlier.

He writes:

'Nature is a principle and cause of change and stasis in that in which it primarily inheres *per se*, i.e. not *per accidens*. I say "not *per accidens*", because someone who was a physician might himself become the cause of his own recovery. But all the same it is not insofar as he has the art of medicine that he recovers, since it has come about *per accidens* that the same man both is a physician and recovers health. Thus the physician and the one who recovers are also sometimes found separately from one another. It is the same with all other things brought about by contrivance. None of them has the principle of the contriving in itself. In some cases the principle is in other things and external, as for instance with a house and anything else made by the hands, while in other cases it is in the things themselves, only not *per se*, since it is *per accidens* that the subjects in which they cause change are themselves.' (II 1, 192b 20 - 32)

So in natural change, the particular subject in which the change takes place is necessarily identical with the particular substance whose nature gives rise to the change. In artifice on the other hand the subject and source of change may be identical, but if so they only happen to be, as is proved by the fact that the same change in the subject could have come about at the hands of another practitioner, and the practitioner who this time treats himself could have performed as practitioner on someone else.

(48) At first sight Aristotle seems to be saying that a natural substance is the source of an intransitive activity, while an artificer is the source of a transitive one. (We here use 'transitive'/'intransitive' to denote formal properties of activities, not grammatical properties of verbs. But we are using the terms in a sense analogous to the grammatical, not with the meaning they bear in the logic of relations.) However, the distinction between transitive and intransitive does not quite make Aristotle's point, since it fails to divide all natural from all artificial processes. In the first place, even where an artificer operates on an external object, his operating involves certain intransitive changes in himself: the surgeon and the builder move (intransitive) in order to produce their intended external effects. Even when the doctor treats himself, the motions involved in the treating can be distinguished from the change (recovery) brought about. Secondly, there are skilled activities such as singing and dancing, which seem essentially intransitive: the dance is the performer's own movements organised to an artistically conceived pattern.

(49) These objections force us to realise that the contrast which Aristotle means is not primarily between natural and artificial activities, nor between changes, but between natural and artificial forms and their respective relations to the agent by whose activity they come to be realised. (Thus the starting point for his philosophy of nature is not after all so philosophically innocuous as might first appear from the initial seemingly commonsensical contrast of nature with artifice. For he is relying, we now see, on an analysis (itself the product of philosophising) of the concept of skill and exercise of skill, in which the artificial form to be realised is singled out as conceptually central.) The exercise of a skill may necessarily involve movements on the part of the artificer, but these are only the means by which the intended form is realised. That is, they are means to further changes in which the realising of the projected form actually consists, *e.g.* the patient's return to health. If it were not for the agent's producing or usually producing changes of this latter kind, we should not describe him as having the skill in question. The skill is defined by reference to the form. Aristotle's point then is that this form and the change which immediately results in it could just as well take place in a subject other than the agent himself, so that if they do occur in him, it is only *per accidens*. By contrast, the form brought about through natural change, and the change itself through which it is brought about, necessarily occur in the very same substance whose nature determines the change. As for the point about the intransitivity of singing and dancing, even here it is possible to distinguish the changes in which the realisation of the desired form consists from those which are necessary as means to these. It is true as a matter of fact that the agent realises the form through changes in his own body, but this seems not to be due to

any inherent necessity for it to be realised in this and no other body as subject, but to the unavailability of other suitably controllable subjects. It might be possible to control the limbs or vocal chords of another person so as to produce the song or dance through his body. It is true that the skill manifested by the controlling agent would not be described as skill in singing or dancing, since *ex hypothesi* he does neither: what he is so cleverly doing would be better described as puppeteering or playing on a kind of instrument. Thus intransitive skilled activities are not really counter-examples to the distinction which Aristotle is making in 192b20 - 32. For although the activity properly described as 'dancing' may be necessarily intransitive, it consists in the realising of a form which could in principle be realised in an external subject. But the form realised in natural change is necessarily realised in the very same individual that gives rise to the change.

(50) In this way the nature of a natural substance is more highly particularised (or more "immanent") than the principle of artifice defining an artificer. Both nature and artifice are embodied in particular agents, and in this respect Aristotle's anti-Platonism is impartial between the two kinds of cause. But they differ in that a particular case of skill (*i.e.* a particular artificer) stands to its effects as a Platonic "one over many", whereas the opposite holds true of nature. The concept of a Platonic Form entails that any number of particulars can participate in it so as to exhibit the corresponding physical property, and however numerous the participants the Form's capacity for being participated in is not exhausted. Similarly the Aristotelian artificer can realise the same form in any

number of particular subjects, and its realisation in one in no way limits this agent's power to produce it again in others. Whereas the relation between the natural substance and the particular subject in which the natural form is to be realised is necessarily one-one, since they are necessarily the same individual.

(51) It is strange that after carefully distinguishing between nature and artifice in the way that we have just examined, Aristotle should shortly afterwards come out with the remark that nature operates like a doctor doctoring himself (II 8, 199b30 - 32). Is it that Aristotle has such faith in his own powers of exposition as to assume that this could cause no confusion once the initial distinction was made? Or is it that he himself was earlier confused in supposing the distinction to be either as clear or as absolute as the opening passage of Chapter I certainly suggests? Obviously the two cases are alike in that the source and the subject of change are the same individual. But perhaps the temptation to use the self-doctoring analogy betrays the fact that we cannot after all conceive of the same individual from these two points of view, *i.e.* as both source and subject, except when the case is one where the source and subject might have been different? In other words, does it perhaps make sense to identify the two only when the identity statement is true *per accidens*? If this is so, then it is incoherent to say that the natural substance as source of change is identical *per se* with the natural substance as subject. Instead we ought to refuse to describe the situation in terms of any kind of identity between source and subject. This does not mean that we should think of "them" as distinct individuals. On the contrary, it means that there is one individual, and

that this one cannot coherently be regarded as instantiating two distinct aspects in such a way that it then makes sense to assert the identity of itself under one of these aspects with itself under the other. All that we can say, then, is that there is a change and an individual that changes, and that such change occurs regularly in individuals of this kind, circumstances permitting. To go further and attempt to distinguish a source and a subject of change within the ontological confines of the same individual can only introduce confusion and pointless mystification.

(52) This criticism is damaging if justified, for it calls into question Aristotle's right to be talking of a thing's nature as a principle of change at all, even though it may not be clear either what it would mean to deny this. On the one hand we should hardly wish to rule against the legitimacy of saying that objects of a given kind change as they do because this is how things of that kind behave;²¹ or that they do not simply change in this way, but are such as to change in this way. But on the other hand, we might decide that the licence to use these expressions is too costly, if the price is a theory of sources that are somehow distinguishable from, but also identical with, their subjects. This is not just the crude reaction of someone unable to see how the same referent can be known and picked out *via* more than one sense (according to Frege's use of that term). For the problem here is compounded by the fact that one of the alleged "senses", *i.e.* that corresponding to the "source-aspect", is not empirically knowable or identifiable at all (*v.s.* paragraph

21. Cf. Charlton, *op. cit.*, pp. 88 - 89.

(44)). We see the morning star, and also, later, the evening star, but we never see the natural substance as giving rise to its change, only as changing.

(53) A full discussion of the issues involved is out of the question here; for the present I shall confine myself to certain points directly relevant to Aristotle. I shall argue first that notwithstanding his use of the self-doctoring analogy, there is good reason to doubt his liability to the objection mounted in paragraph (51). The gist of this objection was as follows: If the natural substance is properly described as source and subject of its own change, then this change is or involves a reflexive activity (such as self-medication). But a reflexive activity is transitive, and as such need not be reflexive: the patient could be other than the agent. It follows that we cannot contrast natural with artificial change on the ground that in the latter, the agent and patient may be different individuals, while in the former they must be the same. For if they must be the same, there is no genuine transitivity; nor, therefore, is there any genuinely reflexive element in the situation. And so it becomes meaningless to say that the same individual is both agent and patient, or both source and subject. Now as it stands this criticism does not touch the position which Aristotle presents in the *Physics* considered as a whole. In the first place, he does not in Book II or anywhere else say that the operation of a natural substance as such is a reflexive activity like curing oneself: he only compares it to the latter. But secondly, this is not because he never articulates the idea of a natural substance operating upon itself. He does exactly this in Book VIII 4-5. Here he speaks of some natural

substances as changing (transitive), and being changed by, themselves, and he also speaks of such substances as somehow comprising within themselves a somehow distinct changer (agent) and changed (patient): But he also makes it clear that not all natural substances are or can be changers of themselves. This reflexive concept applies only to living things, perhaps only to animals, and not to the inanimate simple bodies, earth, fire, etc. Yet he also makes it clear in Book VIII that he retains the idea that a natural substance as such is both source and subject of its own natural change. This notion, then, continues to apply to all natural substances, including those to which the title of 'self-changers' is explicitly denied. This shows that according to Aristotle one can regard a substance as both source and subject without regarding it as both agent and patient. And this entails that even if it is incoherent to assert that the agent and patient are necessarily identical, it does not follow that the corresponding assertion concerning subject and source is correspondingly incoherent.

(54) In Chapter V below I shall examine at length the concept of something's being both agent and patient of its own natural change. But the remarks just made indicate that we ought not to have to make sense of this concept (which is undoubtedly obscure) in order to make sense of the idea that natural substances in general are both subjects and sources. It appears from Aristotle's account in Book VIII that agency and patiency with respect to the same natural change are predicable of the same individual only if that individual displays a kind of complexity not possessed by the four simple bodies. Thus the natural "self-changers" of Book VIII comprise both body and soul, both

matter and form. The simple bodies, being simple in the sense that they are homogeneous masses, lack the organisation that would permit a form/matter distinction in their case, and for this reason (on Aristotle's theory of the soul) they cannot be regarded as ensouled either. But while these considerations show that the general concept of natural substance as both source and subject cannot be attacked on grounds that apply only to the narrower concept of 'self-change', they do not prove that the former is valid or meaningful in itself. A sceptic is entitled to ask how it is possible to make a distinction that applies even to the simple bodies between the source-aspect and the subject-aspect in one and the same natural substance. Why should he allow that there is a distinction if it cannot be explained, and why then should he accept the terminology of "nature as an inner principle"? Now this question can be asked on two different levels, on one of which we shall not attempt an answer. For it may be that what is being demanded is a justification for holding that natural objects are such as to change in certain ways, as opposed to holding that they simply usually do so change, and for all we know, always. Aristotle would surely have regarded this question as lying outside the province of philosophy of nature, like the questions of people who wish to have it proved that change exists, or plurality. This is not to say that had he been faced with Hume, as he was in fact with Parmenides, he would not have undertaken a counter-attack, even while making it clear that the philosopher of science as such is under no obligation to deliver it before pursuing his own line of study. But how Aristotle would have dealt with a Humean attempt to undermine (as he would have seen it) a basic (if not the most basic) presupposition of science, we cannot easily guess. On the other hand, the questioner may grant that it is meaningful and even necessary to say that things

change as they usually or always do because they are such as to do so, while still wondering in what way a distinction can be drawn between the object as a source and as a subject of its changes. On this level one might answer as follows.²² Fire (*e.g.*) is such as to move towards and come to rest in the upper region, whenever it is not prevented. Accordingly it does so move and come to rest, when it can. It may cease to function both as source and as subject of this change, but the ceasing takes a different form in each case. If the fiery mass is kept down by force, it cannot function as the subject; similarly if it has already reached the upper region; it then has nowhere upwards to move. But it remains true that it is such as to move upwards when it can. On the other hand it could be treated in such a way that it ceases to be such as to move upwards, *i.e.* to be a source of this change. Such treatment would involve converting it into a different type of object, one which is such as to behave differently. These obvious remarks point to the following conclusion: either there is no difference between saying (i) that the fire is no longer in a position to move upwards, and (ii) that it has ceased to be fire and such as to move upwards; or we must recognise a difference between the fact that something is (of the nature of) fire, and the fact that it is actually a subject of motion in accordance with that nature. Although I have taken an example from Aristotelian physics, this argument can be applied just as effectively to what we should consider scientifically established facts. Sugar is such as to dissolve in water. This is true of the sugar lump before it is immersed in water, *i.e.* before it is in a position to be subject of

22. Cf. P.T. Manicas, 'Aristotle, Dispositions and Occult Powers', *Review of Metaphysics* XVIII, 1964-5, pp. 678 ff.; and Mourelatos, *op. cit.*

the change. So long as we find it necessary to distinguish between the fact that sugar is such as to dissolve, and the fact that some sugar is dissolving, we shall be regarding sugar as both source and subject of its change.

APPENDIX TO CHAPTER I

On the interpretation offered here of Aristotle's account of coming to be in *Physics* I 7-8, every becoming involves a subject which "remains", and this subject is a substance. But it is arguable that this position holds only of non-substantial coming to be. Space does not allow a full discussion of this question, and here I shall only consider what is agreed to be the most problematic type of case, *viz.* the coming to be of natural substances. The claim that the coming to be of a natural substance involves a substantial remaining subject faces two main difficulties:

- (1) Aristotle's own statement of what the subject is in these cases suggests that it is not something that "remains", for he says that in the case of living things, it is the 'seed' ('σπέρμα', 190b4-5); but a 'seed' is not as such still present in the product of the change (in the way in which man is present in the product cultured man).
- (2) It has often been held (partly no doubt because of difficulty (1); *cf.* Charlton, *op. cit.*, p. 77) that the "remaining" subject of natural substantial coming to be is "prime matter" in the scholastic sense, and this is not a substance.

Briefly, I would reply:

(a) So far as (2) is concerned, I agree with Charlton that there is no clear evidence that Aristotle introduces the concept of prime matter (in the above sense) in *Physics* I (Charlton, *op. cit.*, 77 ff. and 129 ff.), although I would hesitate to accept Charlton's broader thesis that it never appears in Aristotle. (On *Physics* I, see also B. Jones, 'Aristotle's Introduction of Matter', *Philosophical Review* LXXXIII, 1974, pp. 474 ff.) Prime matter (or at any rate an in-itself-unknowable and inseparable subject) seems a necessary presupposition for one type of substantial coming to be, *viz.* the transmutation of the simple bodies into one another described in *De Gen. et Corr.* and *De Caelo*. However, in *Physics* I 7-8 Aristotle does not appear to consider this type of case at all. His examples of generation are of plants and animals, where the new substance cannot be described as coming to be through transformation from a different sort of substance (*pace* Ross, *Aristotle's Physics*, p. 22), but only as coming to be.

(b) The theory of "nature" expounded in *Physics* II shows how Aristotle could coherently hold that organisms undergo a process which (i) is not a change in quality, quantity, etc., (or in any category other than Substance), but (ii) has for its subject an identifiable describable substance. On this view, the subject-substance in generation is the same individual as the eventual mature creature. While development goes on, the subject-substance is identifiable and characterisable as a creature in process of developing the features typical of mature members of the species. This process cannot be classified as a change in any of the non-substance categories, for a change in these presupposes a subject whose nature is definable without reference to the end-state of the change. (What it is to be cultured does not enter into what it is to be a man.) On this account the fundamental difference

between substantial and non-substantial coming to be is preserved without resort to a non-substantial unknowable and unidentifiable subject (prime matter).

(c) However there seems to be a difficulty. The developing but undeveloped organism cannot be the subject of development, because the subject "remains", and the undeveloped, *qua* undeveloped, does not "remain". (This problem led Charlton to the conclusion that Aristotle does not believe in a "remaining" subject at all for generation. Since Aristotle makes it clear that there is a subject (the 'under; lying thing') in all cases of becoming, Charlton has to maintain that by 'subject' Aristotle does not always mean 'that which remains through becoming'; which seems highly improbable. See Charlton, *loc. cit.*) But this would be a genuine problem only if there were no single substance-constitutive characteristic applying both to developing and to developed organism (giving the covering concept "under" which "they" are the same individual). But there is: in both its phases the creature embodies the same nature in the sense of principle of life and change typical of members of its kind (see Chapter II, paragraphs (19) - (20)).

(d) Ordinary organic-substance terms generally direct one's mind to the mature form. Thus although the subject of generation may truly be said to be all along a human being, it would be misleading to describe it as such; for then when we say that it develops into a human being we seem to say that it becomes what already it is. For this reason, I suggest, Aristotle in *Physics* I 7 prefers to call the subject a 'seed' (= embryo, not semen, in the case of animals; *cf. De Gen. An.* I 20, 728b32 - 34 and Jones, *op. cit.*, pp. 488 ff.), even though this locution risks making it seem that the subject "disappears" before the change is over, hence is not a "remaining" subject (but more like a contrary replaced). Unfortunately no handy terms are neutral as between developed and undeveloped; but Aristotle is used to our ordinary vocabulary running dry when it comes to providing names for all the facts that his analyses enable him to distinguish; *cf. Physics* I 5, 188b10 - 11, *Eth. Nic.* II 7, 1107b1 - 2.

CHAPTER II

What Things Have Natures?

(1) Ordinary experience seems to afford plenty of examples of objects endowed with Aristotelian "natures". This point was mentioned in the last chapter (paragraph (37)) with the proviso that the apparent examples can only be accepted as genuine if the general notions of "nature" and "natural change" are themselves coherent and viable. From now on, this proviso will be taken for granted. But a question still remains concerning the extension of the concept of "nature as an inner principle of change". Even if we assume it to be instantiated, which if incoherent it could not be, we are not automatically entitled to the further assumption that whatever seems to instantiate it does so in fact. Now Aristotle himself says that all the things that exist by nature,

'... animals and their parts, and the plants and the simple bodies such as earth, fire, air and water - for these and the like we say exist by nature - all manifestly differ from things not constituted by nature, in that each possesses within itself a principle of change and stasis.'
(II 1, 192b9 - 14)

It is indeed a 'manifest difference'. But does Aristotle mean that the difference is real in all these cases, as well as clearly displayed; or might he mean that in all these cases there is a clear display of a difference that may or may not in every case be real? Even if he unhesitatingly means the former, we might expect him, here or elsewhere, to give some attention to the question of grounds for deciding which those things are that are to be assigned the status of natural substances. For this is what is implied by saying that a being has (in Aristotle's sense) a "nature". And although it may be certain

on metaphysical grounds that all change can be traced back to natural substances whose nature it is to change "of themselves", this does not tell us what things are natural substances. It is when we turn an analytic eye on the objects of our experience, bearing in mind the full meaning of 'nature', that we may well begin to doubt whether Aristotle is justified in holding that all the objects listed above¹ are really endowed with natures.

(2) The problem more specifically concerns Aristotle's right to suppose that a complex physical object is endowed with an Aristotelian nature. This may seem an extraordinary question, since for him organisms, which even in their most primitive forms are structured and complex, are the paradigms of natural substance. Yet the enquiry has point in the light of the following considerations. Such beings are composed of physical parts, and the parts too may be complex. Experience shows that these beings and their parts are made up of the apparently simple unorganised stuffs which Aristotle calls the "simple bodies", earth, fire, water and air. For when the more highly organised beings perish, they decompose eventually into these apparently simple stuffs, and when alive they take these stuffs into themselves by way of nutrition. It is therefore not unreasonable to suppose that the organic complexes and their structured parts consist of a few universal basic materials differently arranged and modified. On this supposition, the complexity of the complex being appears to involve both (a) physical and (b) logical composition. For (a) the being has parts

1. As A. Mansion points out, *Introduction à la Physique Aristotél-icienne*, pp. 57 and 118, the choice of these examples of natural substance rests only on 'l'usage'.

that are external to one another, and (b) these parts are, or are made of, substances modified in various ways. Now these modifications can scarcely be regarded as *per se* attributes of the substances in question, for if this were the case, how could it also be the case that the same few basic substances are capable of as many different modifications as would be required to account for the vast variety of complex entities? The fewer the basic materials (and theoretical economy demands that few should be postulated rather than many), the more indifferent each in itself must be to which of a large range of possible modifications is realised in it in any given case; for if the kinds of elements are few, their modifications and combinations must be many to account for the diversity of nature.

(3) From the point of view just sketched, it is difficult to see how a complex natural entity is not automatically on a logical par with a *per accidens* combination of mutually external circumstances. Such a set of circumstances may jointly cause a change, but they cannot on that account be regarded as collectively exhibiting a "nature", precisely because their union is only *per accidens*. Now we call a complex object an object or thing presumably because it preserves its unity for a noticeable length of time. But apart from this, which seems an arbitrary distinction, what difference is there between such a "thing" and what we would normally be inclined to call a set of circumstances? What difference, in other words, is there between a physically complex object that changes "of itself", and a set of mutually external factors one of which externally determines a change in another of the set? Once we have taken into account all the factors that determine an externally determined change in a given object, why

should we not regard these, together with the changing object itself, as forming a single (even if not necessarily a stable) entity which changes as a whole because part of it changes through external determination by other parts (just as a man, Aristotle says, may be said to move if a part of him moves: see *Physics* V 1, 224a23 - 26)? *Ex hypothesi* this "single" changing entity changes "of itself", *i.e.* not through external determinants, because all the determinants have been included within it. Now if Aristotle would refuse, as he would, to attribute a "nature" in his sense² to such a set of mutually external factors, on the ground that it is not a unity of the proper type, what grounds has he for attributing "natures" to complex objects such as organisms?

(4) There is another way of putting the same problem. Given that Aristotle regards *e.g.* organisms and their organs as having natures, although they are complex, on what grounds could he refuse to attribute "nature" to a self-moving artifact? We cannot dismiss this question for the reason that self-moving artifacts would have been beyond his power to conceive, for apparently they were not:

'If every instrument could accomplish its own work, obeying or anticipating the wills of others, like the statues of Daedalus, or the tripods of Hephaestus, which, says the poet, "of their own accord entered the assembly of the gods": if in like manner the shuttle could weave and the plectrum touch the lyre without a hand to guide them, chief workmen would not want servants, nor masters slaves.'
(*Politics* I 3, 1253b33 - 1254a1)

Of course, if only gods and their kin can make self-moving artifacts, then the latter are as mythical as the former, and hardly need to be

2. This is not to say that he would have denied that it exists 'by nature', φύσει.

taken into account in a philosophical classification. But in *Physics*

II 8, 199a12 - 14, Aristotle writes:

'If a house were one of the things that come into being by nature, it would come into being in the same way as it actually does through artifice. And if natural things came into being not only by nature but also by artifice, they would do so in the same way as they do by nature.'

(By 'in the same way' Aristotle means in the same order of steps, each being a means to the final result.) It seems then that we cannot rule out the possibility that Aristotle might have had man-made automata in mind even while writing *Physics* II 1, and only chose inert artifacts to illustrate his initial distinction because (a) they are the obvious examples (for his audience) of artifacts, and (b) they obviously contain no principle of change (*qua* artifacts).

(5) Aristotle would certainly have regarded automata (even divinely made ones: Hephaestus was a craftsman) as artifacts, hence as not possessing natures. Now an artifact simply is a combination of simpler objects put together in such a way that when each part behaves according to its nature, the whole system comes to be in a certain desired condition, or changes in a certain desired way. The parts are together *per accidens*, for if they were of their own natures thus combined, there would have been no need of artificial construction *ab extra*. If then we suppose that complex natural substances are *per accidens* combinations, it follows that the distinction between complex natural substances and artifacts is not fundamental. It may be true that all natural complexes have an inner principle of motion: but then so do some artifacts (automata). And since self-moving artifacts are constructed on essentially the same principles as the inert ones more familiar to a pre-technological era, it follows

that if complex natural substances are comparable to automata, they are comparable to artifacts in general. Of course the genetic process is different in each case, but what comes into being in each case is a system of essentially the same logical type, demanding the same type of explanation for its behaviour and characteristics (even though giving the explanation may be more difficult in the one case than in the other). In short, the distinction between complex natural substances and artifacts is not fundamental unless a certain assumption is true: *viz.* that expressions such as 'natural substance' and 'having a nature' are not appropriate terms for just anything that "changes from within", but only for a special kind of thing, a *per se* unity, whose changes, unlike those of a machine, cannot be wholly explained by the changes of simpler components. Now for Aristotle, it seems certain, the distinction between artifacts and natural substances is indeed absolute, despite his awareness of the possibility of automata. It follows that his entitlement to apply the concept "natural substances" to such things as organisms rests entirely on his ability to show that these are *per se* unities. This is the question with which I shall be concerned in this chapter.

(6) The problem touches not only Aristotle's employment of the concept "nature", but also his ontology. If there is doubt whether organisms (for instance) are *per se* unities, there is doubt whether they are substances properly speaking. A *per accidens* unity, *e.g.* that expressed by 'doctor' (= 'medical man') may indeed be a subject of attributes, as when we say 'The doctor came and went', but what this subject is cannot be expressed by a unitary formula, and there cannot in the strict sense be definition of such a thing. In the

previous chapter we argued the intimate connection between the concept of nature and that of substance, and in *Physics* II 1, 193a9-10, we find Aristotle speaking of the 'nature and substance' of natural beings as if these are alternative expressions.³ Thus an attack upon the *per se* unity of a thing is an attack both on its claim to be endowed with a nature, and on its claim to the status of substance.⁴ Now in *Metaphysics* Z 2, 1028b8-13, Aristotle gives a list of things that are held (δοκεῖ) to be substances. This corresponds to the list of things having natures at the beginning of *Physics* II 1, except that in the *Metaphysics* passage he also includes the heaven and the heavenly bodies. But in the course of his elucidation of 'substance' in Z, he finds reason for rejecting some of the items in the 'ἐνδοξον', namely the parts of animals (and presumably of other living things) and the simple bodies (Z 16, 1040b5 ff.).⁵ On this last point the *Metaphysics* doctrine differs from that of the *Physics*. For the equation in *Physics* II 1, 193a9-10 of "being a substance" with "having a nature (= inner principle of change)" entails a substantial status for the simple bodies. However, the point that mainly concerns us here is that in neither work does Aristotle hesitate to include such complex beings as whole organisms. Thus, for instance, in discussing "becoming" in

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3. Cf. *Metaphysics* Δ 4, 1015a13-15. For the indefinability of *per accidens* unities, see *ibid.* Z 4, 1030a2 ff.
 4. These remarks together with paragraph (4) imply that artifacts are not substances, a position which may seem paradoxical given that they supply Aristotle's favourite illustrations for the form/matter distinction, which is of primary significance in connection with substances. Yet he himself denies substancehood to artifacts in *Metaph.* H 3, 1043b21-23. Cf. W. Charlton, *Aristotle's Physics I, II*, pp. 75-76.
 5. See also *Metaph.* Λ 3, 1070a20-21. Parts of animals do not count as substances because they have no 'separate existence' (*v.i.* paragraph (41)), the simple bodies because they are without structure, 'like a heap'.

Metaphysics Z 7, he says: '... and what comes into being is a man or a plant or the like, which things above all we say are substances'. (1032a18-19) And although there is no such explicit declaration in the *Physics*, this is clearly only because he regards it as unnecessary. But how is it that Aristotle is so certain? And who are "we" in the above-quoted passage who "say" with such certainty? As so often, it is not clear whether Aristotle means himself, or the consensus of philosophical opinion, or common sense, or all three. Common sense of course takes men, plants etc. to be as genuinely real as anything can be, just as it takes tables to be solid, but equally of course it has no views either way on the question of their metaphysical status as substances.

(7) It is worth considering briefly why Aristotle *qua* metaphysician needs to commit himself on the question of which types of natural objects have substantial status. For this question appears to be an empirical one, insofar as it depends on deciding what phenomena are to be explained as combinations of constituents. The plausibility of the hypothesis that a given type of complex is to be thus explained rests with the empirical evidence.⁶ It is difficult to see how Aristotle could have rejected this point out of hand. But once it is admitted to be an empirical question whether this or that sort of object is a "substance", it is not clear how the metaphysician can continue to maintain his certainty that the concept of substance does apply to the natural world and plays an essential part in the conceptual

6. Cf. A. Gotthelf, 'Aristotle's Conception of Final Causality', *Review of Metaphysics*, p. 253: 'Philosophers of science today are in increasing agreement that the question of reduction is an empirical one ...'.

framework of science. For if the question is empirical, the conclusion that any given type of object is a substance would always be subject to revision from new evidence. Even the so-called "simple bodies" might turn out to be complexes of elements. The metaphysician might continue to maintain that there must be *per se* unities, since otherwise there would be nothing for *per accidens* combinations to be combinations of; but he could not identify any of the former for certain, nor therefore any of the latter. According to Aristotle's scheme, this entails that we should never know for certain which of our definitions of things were in the strict sense definitions. But if, despite this, science can still keep going, then in what way is the concept of substance as *per se* unity necessary for science, and what function can it have in a philosophical account of how the scientist does or should operate? It is not clear that it has any value even as a regulative principle: on the contrary, it might well be argued that science should proceed on the assumption that there are no ultimate unities in physical nature. And although this does not entail that none exist, what is the advantage, either to science or to metaphysics, of holding that they do? So far as the knowledge of nature is concerned, physical substances would be as otiose as Platonic Forms.

(8) With these issues in mind we turn to the text. In *Physics* II 1, having stated what nature is, and that it would be absurd to try to prove its existence, Aristotle continues:

'Some hold that the nature and substance of natural beings is, in each case, the immediate

constituent that is in itself unstructured,⁷ so that *e.g.* the wood is the nature of a bed, the bronze of a statue. Antiphon says that this is indicated by the fact that if one were to plant a bed and the rotting wood got the power to send up a shoot, what came up would be not a bed, but wood: which shows that the arrangement in accordance with the rules of art is in it *per accidens*, whereas the substance is the wood, which also remains continuously present while subject to this arrangement.' (193a9 - 17)

Aristotle has himself made the point that it is not the bed as such that has a nature, but the wood; his reason was that the bed is an artifact, the wood is not. Antiphon's point as Aristotle presents it is rather different. It is that the wood is endowed with nature because the wood is matter as opposed to form, 'the immediate unstructured constituent'. For Aristotle continues:

'And if each of these things [*sc.* such as wood] stands in this same relation to something else, *e.g.* bronze and gold to water, bones and wood to earth, and so on, the latter is their nature and substance. For this reason some hold the nature of things to be fire, others earth, others air, others water, others some of these and others all. For whatever thing any of these theorists takes to be of this sort, whether one thing or more than one, this or these he says are the whole of substance (τὴν ἅπασαν οὐσίαν), and all other things are affections, states and arrangements of these. Each of these moreover is eternal, since they do not pass away out of themselves, while all other things come into being and pass away time after time without end.'⁸ (193a17 - 28)

7. 'Το πρῶτον ἐνύπαρχον ἐν ἐκάστῳ, ἀρρύμiston δὲ καθ' ἑαυτό'. The context shows that Aristotle means stuffs such as wood, not the "prime matter" of the scholastics; *cf.* W.D. Ross, *Aristotle's Physics*, p. 502. It is doubtful whether "prime matter" ever appears in the *Physics* (*cf.* W. Charlton, *op. cit.*, pp. 78 - 79 and 129 - 145, where it is argued that "prime matter" is not an Aristotelian concept at all). If it does occur in Book II, it is only in the most oblique fashion: see paragraph (16).

8. *Cf. Metaph.* Δ 4, 1014b26 - 35. I take 'the whole of substance' to mean (i) that the simple bodies are all the substances that there are, and (ii) that they give substantiality or being to other things by constituting them.

(9) Aristotle does not dispute that complex physical objects are made of and can be broken down into a few simple stuffs (see, e.g., *De Caelo* III 3, 302a10 - 25). The fundamental difference between his position and the materialists' (to use a convenient label) concerns the following question: given that O is made of M_1 , M_2 , etc., does it follow that O has no nature apart from the natures of M_1 , M_2 , etc.? Alternatively: does it follow that O is nothing but M_1 , M_2 , etc., in certain states and arrangements? An affirmative answer sums up the materialist position presented in the passage above. According to this, not only artifacts fail to count as natural substances, but all natural objects composed of natural substances. For the composite is only its constituents combined, hence it is no single substance with a unitary nature in its own right. So if Aristotle is consistently to maintain that men, plants, etc., are such single substances, his answer to the question just posed must be negative. But before turning to this, let us consider the materialist position in more detail.

(10) The case as Aristotle presents it falls into two parts:

(i) where it is claimed that the "nature" of a thing is its immediate matter (193a9 - 17) and (ii) where it is claimed that the only real substances or things with natures are the elements that ultimately underlie all physical objects (*ibid.* 21 - 23).⁹ The second claim is reached from the first by analogical reasoning (*ibid.* 17 - 21): if what a structured thing is immediately composed of is its nature, then

9. Cf. J. Burnet, *Early Greek Philosophy* (4th edn.), pp. 10 - 12, 363 - 364.

whatever what composes it is composed of must be the latter's nature, and so on until we arrive at some stuff or stuffs that are not themselves composed of anything. Now it is strange that Aristotle does not notice that this analogical argument leads to a conclusion quite contrary to the intended one. For if the nature of a thing is the matter of which it is immediately composed, then simple stuffs which are not themselves composed of anything cannot be said to have a nature: in which case, how can they be the nature and substance of everything else? It seems that Aristotle has missed a point that favours his own position. For he could have argued: if there are ultimate constituents, then either they themselves have natures, or not. If not, then the internal principle of change in a complex being cannot be identified with the nature of any ultimate constituent of it; in which case there is room to argue that the complex being has, as a whole, its own nature, and therefore is a genuine substance. But if the ultimate elements do have natures, then "having a nature" does not necessarily depend on being composed of something; and in that case, there is room to argue that although a complex being is composed of simpler substances, its having a nature does not consist in its being thus composed, so that there is no ground for the claim that the nature it has is not really its nature, but that of some simpler constituent or constituents.

(11) Thus there are particular reasons why the analogical argument fails as a link between parts (i) and (ii) of the materialist position, but in fact no argument could succeed. For given the synonymy of 'having a nature' with 'being a substance', it follows that if either part is true the other is false. If earth, fire, water etc. are 'the

whole of substance', then wood, being composed of these, is no more a natural substance in itself than the bed is.¹⁰ The contradiction could be avoided by making 'substance', like 'matter', a relative term, or else by making it admit of degrees. Thus one could say that the wood is a substance relatively to the bed, or that it is more of a substance than the bed is, being fewer removes from the ultimate (and non-relative) substances. If any materialist did hold both (i) and (ii) as a unified position, he would be compelled to admit that 'substance' can be said of wood only in a qualified sense. But there is some reason to think that (i) and (ii) actually represent distinct positions, each employing a different criterion of substancehood or nature. According to Aristotle, those who claim that a thing's immediate matter is its substance or nature support the claim by pointing to cases in which the immediate matter can propagate or reproduce itself, while the thing as a whole (*e.g.* the bed) cannot. Thus they seem to be identifying the nature of a thing with whatever it is in it that gets itself reproduced without external contrivance. But if this is the criterion of nature or substancehood, then 'substance' in this connection is being used in an absolute sense: for the proposition that *e.g.* wood can reproduce itself is simply true, not true in relation to a particular conceptual context (like the proposition that wood is matter). Thus positions (i) and (ii) cannot be combined in the way suggested above. And in any case, the use of "self-reproduction" as the criterion for 'nature' fits badly with the view that the only real substances with natures are the primitive elements. For on this view, as Aristotle reports it

10. This appears to be the meaning of Empedocles fr. 8 Diels, quoted in *Metaph.* Δ 4, 1015a1-3, on which see W.D. Ross, *Aristotle's Metaphysics*, vol. I, pp. 297-298.

(193a26 - 27), the elements are held to be eternal, hence neither propagated nor reproduced. Indeed, this supposed eternity appears to be the criterion followed in identifying these elements with 'the whole of substance': the presumption being that only the eternal is truly real, so that transient things are merely the latter's modifications.

(12) Now the two materialist positions just distinguished have one feature in common: they both contradict Aristotle's own view that structured organic beings have, as such and in their own right, substancehood and nature. But they are sufficiently different to need to be argued against separately. It is therefore surprising, not to say disappointing, to find Aristotle treating them as a single position, or rather, as if the second were entirely merged in the first. For he opens his reply as follows:

'So according to one way of looking at it, nature is said to be the immediate underlying matter in each of those things that have within themselves a principle of motion and change. But according to another way, nature is the shape and the definable form.' (193a28 - 31)

He then goes on to argue (a) that it is right to regard form too as nature, and (b) that the form of a thing is its nature more than the immediate matter is (193b6 - 7). And this is the whole of his reply in *Physics* II 1 to the materialists. In other words, he here makes out no explicit case at all for the claim of form to be nature as against the claim of the non-immediately underlying matter, *i.e.* the more basic constituents. Nor, as we shall see, do his arguments in II 1 offer even an implicit defence against the second materialist position. Yet it is this position that seems to the modern reader so clearly to present the real menace to Aristotelianism. In

particular, it seems to make teleological explanation redundant or even meaningless. It is strange that in II 1 Aristotle appears unaware of the danger from this quarter. But by the end of Book II he has recognised, and, I shall argue, replied to it in full.

(13) Meanwhile, let us return to his more immediate concern in Chapter 1. He begins as follows his attack on the materialism that identifies nature with the "immediate" matter:

'Just as the word "art" is applied to what is by art and an artifact, so the word "nature" is applied to what is by nature and natural. In the former case, we should not say that anything is by art while it is only potentially a bed and does not yet have the form of a bed, and nor do we say that it is art. It is the same with things constituted by nature. For that which is potentially flesh or bone does not yet have its own nature [*sc.* as flesh, etc.] until it acquires the form specified in the definition, and nor is it by nature. Thus on this other account [*sc.* of what nature is], nature would be the shape and form of those things that have within themselves a principle of change, not separable from them except in formula. The combination of these [*i.e.* the form with the matter], as for instance a man, is not a nature, but by nature.'

(193a31 - b6) 11

(14) This argument is based on usage, and as with all such arguments it is not clear how linguistic premisses can establish a philosophical conclusion. But the present instance has defects of its own as well. It depends on a play on words, and on a question-begging use of the analogy between art and nature. In the first place, the remark 'that which is potentially flesh or bone does not yet have its own nature [*sc.* as flesh, etc.] until it acquires the form

11. Cf. *Metaph.* Δ 4, 1015a4 - 7.

specified in the definition' may be taken two ways. On the one hand it states that something cannot be said to be a thing of a given kind unless it has the typifying characteristics of that kind, and that the typifying characteristics include the form, not merely the matter (what is 'potentially' the thing in question). Here, 'nature' is being used to mean typifying characteristics, or what one would mention if asked to say what the thing is.¹² In this sense the remark is a virtual tautology; but in this sense too even artifacts have "natures". Such "natures" are not the prerogative of *per se* units or substances in the strict sense. They belong to anything whatever concerning which it is possible to state what it is. Thus to take an example of Aristotle's,¹³ we say what a threshold is by saying that it is a piece of wood in a certain position; but this position occurs only *per accidens* in the wood considered as wood. However, 'nature' in the sense with which Aristotle is primarily concerned in *Physics* II 1 means 'inner principle of change'. On this other reading, the sentence just quoted asserts that an object's inner principle of change cannot be or be grounded in its component materials alone, and must therefore be (or at least depend upon) the form. But this is not only not a tautology, it is not self-evident either, considering that it expresses precisely the conclusion which Aristotle by this argument is in process of trying to prove.

12. Cf. Mansion, *op. cit.*, pp. 102-103, and I. Düring, 'Aristotle on Ultimate Principles from "Nature and Reality", *Aristotle and Plato in the Mid-Fourth Century*, edd. Düring and Owen.

13. Cf. *Metaph.* H 2, 1043a7-8.

(15) In the second place, Aristotle uses the analogy between nature and art to insinuate that the material of a structured natural object of type T is devoid of nature of its own so long as it has not yet received the specific form that makes it of type T. From this it would follow that nature (in either of the senses above distinguished) resides in form rather than in matter. If this seems plausible, it is because of the alleged parallel with art. As Aristotle points out, 'art' (in the sense of 'work of art'¹⁴) is properly applied to the product, not to the raw materials of an artifact. Since the materials become the product called 'art' by taking on some imposed artificial structure, there is good reason to hold that the product's 'art'-status depends upon the structure or form alone, since the materials necessarily acquire the one when they acquire the other, and *vice versa*. But a similar conclusion cannot be drawn for 'nature' unless it is as certain that the materials composing natural objects lack natures as that the materials of artifacts lack 'art'. Now the raw material of an artifact by definition lacks 'art' in the sense of 'artificial structure'. It also lacks art in the sense in which an artificer has 'art', *i.e.* the power to cause artificial change - necessarily so, since if the wood were able to turn itself into a bed, a bed would not be an artifact but a natural substance containing its own principle of growth. But the immediate matter of a structured natural substance does have a 'nature' in the sense of a definite character: it is flesh, etc. And so far Aristotle has said nothing to show that it does not have 'nature' in the sense too of 'inner principle of change'. And if it does, we have been given as yet no reason against supposing that the

14. Cf. Charlton, *op. cit.*, p. 90.

natural changes of a structured natural object of which flesh etc. is the material are not entirely due to, or indeed identical with, changes whose source is the nature of flesh as such. In any case, the art/nature analogy cuts two ways. Aristotle would hardly wish to deny that the materials of artifacts have natures (inner principles of change), since the materials of artifacts are natural substances. So, if natural structures are analogous, why not say that the materials of natural structures also have natures? And if this is conceded, the way is open (for all he has so far shown) to the further conclusion that the nature of a structured natural object is nothing but the nature of its material. Such is the lesson which Antiphon draws from the analogy between art and nature, and on the present showing he is as much entitled to his conclusion as Aristotle to his.

(16) We found fault with Aristotle's equivocation between two senses of 'nature', but the confusion also suggests an insight on his part which we have so far ignored. For although it is not the case that everything with a definable character possesses, as such, an internal principle of change, the converse does hold. Anything that has a nature in the second sense must be of a definite character. Since changes from within are expressions of what it is, there must be a positive answer to the question 'What is it?'. From this point of view, Aristotle's argument effectively answers a purely metaphysical "materialism", such as would seek to identify the source of change with "prime matter", or the indefinite ('ἀόριστον')¹⁵ partic-

15. Cf. *Physics* III 2, 201b24 - 27.

ularising element in a concrete thing, discernible only metaphysically from its "whatness".

(17) This position may be part of what Aristotle is opposing in II 1, 193a31 - b6. But if so, his presentation is far from clear. In the first place empirical cases such as that of the bed sprouting are irrelevant. Secondly, the distinction between immediate and "remote" matter employed at 193a10 only makes sense as applied to empirically characterisable components at different levels of physical analysis. Thirdly, he does not maintain that matter contributes nothing to a thing's nature, only that the rôle of form is paramount. But the pure particularity of a thing cannot in any sense be or contribute to its nature. For the natures of things are, after all, what the natural scientist is supposed to study. This last point incorporates what for Aristotle would be the decisive objection against identifying the source of natural change with the metaphysical principle of particularity: for since the particularity of things lies beyond or below the scope of science (*cf. Metaphysics* B 6, 1003a14), so, on this view, would the causes of change. So far then, the position which Aristotle has countered is a mixture of empirical and metaphysical materialisms. While he may be assumed to have answered the latter, he has made no headway against the former. In particular, the metaphysical thesis that the source of change must lie in the definite character of something, tells neither for nor against the theory that the only true substances and natural sources of change are the basic (but empirical) elements, earth and fire, etc.

(18) Arguing still in II 1 that nature is form, Aristotle continues:

'Moreover, man comes into being from man, although not bed from bed. This is their reason for saying that the wood, not the structure, is the nature: because if it grew what would come into being would not be a bed but wood. But if this is nature, the shape too is nature, since man comes into being from man.'
(193b8-12) 16

Here Aristotle is explicitly attempting to show what so far he has not shown, that nature in the sense of the defining shape is also nature in the sense of principle of change. Growth and reproduction are the changes that are significant for this argument. Here Aristotle is accepting Antiphon's criterion for "nature", *i.e.* that what has a nature is what reproduces itself, but saying in effect that Antiphon's conclusion is based on just one type of case, and not even a representative one at that. As soon as we look past the bed example we find ones where something of a given structure produces something else of that same structure. It is not clear whether by 'Man comes into being from man' Aristotle means growth of an immature into a mature human, or the begetting of one by the other, or both. But if Antiphon were right, man, whose "immediate matter" is flesh, bones etc., would only give rise (in either sense) to flesh and bones not organised as a man (or if so, only by accident). And there is no reason to think that Antiphon is even right in some cases, since his example is an artifact, which as such has no nature. Not only is it false then to say that its nature lies in its matter, but the example provides no ground for

16. I have translated Ross's text, but the MSS 'ἐκ δ' ἄρα τοῦτο τέχνη' yields an argument with the same import.

saying this of any natural kind.

(19) Aristotle's objection to Antiphon, that man gives rise to man, was based on a fact of experience. But Aristotle now moves the discussion back on to the linguistic level, and draws further support from 'what we say' or rather, the presumed etymology of 'what we say'), by means of the following obscure dialectical argument:

'Moreover, "φύσις", in the sense in which the word is equivalent to "genesis", means the process by which something arrives at its nature (φύσις).¹⁷ For it is not like "curing", which denotes not the process towards the art of curing, but towards health. For whereas curing necessarily proceeds from but not to the art of curing, φύσις is not related in this way to φύσις. Instead, the growing thing ("τὸ φύομενον") passes from something into something, insofar as it grows. What, then, is the growing thing? Not that from which, but that into which. The shape, then, is the nature.' (193b12 - 18)

This passage is confusing because Aristotle's point depends upon a contrast between nature or φύσις, and activities or artifice such as medicine; yet at the same time he relies on certain features common to the two cases. In both, the process results in a "shape", *i.e.* a structured state of affairs, whether this is the balance of qualities within the cured patient's body, or the mature form into which a natural substance develops. (In both cases too, although he makes no direct allusion to this point, the specific character of the process is defined by reference to the sort of "shape" achieved.) Now for the contrast. Firstly, the state in which the process of healing

17. Cf. *Metaph.* Δ 4, 1014b16 - 17, with Ross's comm., vol. I, p. 296, and Mansion, *op. cit.*, pp. 104 - 105.

results is not medical art, *i.e.* the state of the healer which is source of the healing process. But the natural process of growth denoted by the word ' $\phi\acute{\upsilon}\sigma\iota\varsigma$ ' (in the sense in which this means 'genesis') does result in a state that in turn gives rise to such processes, and this state is also called ' $\phi\acute{\upsilon}\sigma\iota\varsigma$ '. Evidently Aristotle is thinking of the fact that man generates man: *i.e.* that a full-grown man is a source of processes (in offspring) identical to that by which he developed. Secondly, the agent that does the healing does not (*qua* healer) come to be in any new or more developed condition; whereas the natural entity that "does the growing" itself passes into the developed state. Thus a kind of conceptual coincidence obtains between (a) the concept of the developed natural state and (b) the concept of the source of the process that gives rise to that state, for which there is no parallel in the case of curing. For in the first place, as we have just seen, the developed state in which the natural process results coincides with a condition which is itself a source of such processes. And secondly, when we ask (as in the second to last sentence of the quoted passage) what the growing thing is, *i.e.* what sort of a growing thing it is, the answer is given by predicating of that object the same word as is used of it in the developed state. Thus we say that a tadpole is a (developing) frog, a child a (developing) human being, whereas we do not say that a doctor as such is a (coming to be) healthy person. Now the developing creature is not merely developing, but also still contains within itself the source of its (continued) development. For if by developing to some extent it somehow lost this principle of change, it could not be said to be still developing. Thus the developing creature has firstly, $\phi\acute{\upsilon}\sigma\iota\varsigma$ in the sense of the process

of growth, and secondly, φύσις in the sense of the inner source of this change. It is also defined by the term denoting what it will develop into, which term, being definitive, gives its φύσις or nature in yet a third sense, the sense in which the nature of a thing is what somebody asks for who asks to be told what it is. Putting all this together, we may say (i) that both *qua* developing and *qua* developed, the natural substance is endowed with an inner principle of change; and (ii) that if 'C' is the predicate expressing the form when fully developed, or as Aristotle says, the "shape", the creature both *qua* developing and *qua* developed is to be defined as a C. From this Aristotle concludes that nature in the sense of an inner principle of change is the developed form or shape.

(20) Now it might be objected that despite the close dependence just exhibited between nature as principle of change, and the developed structure or "shape", Aristotle exceeds his warrant in concluding that the former is the latter, since by the very terms of the argument, the latter is the result of the former, and is not always actually present at the same time. This indeed is perhaps the main difficulty surrounding the Aristotelian concept of "form", which in a living thing at any rate is supposed somehow to comprise both efficient and final causes of the substance's natural behaviour. How can what something is to be, which it necessarily is not yet, be what brings about the present process towards what is to be? Writers sympathetic to Aristotle have failed to explain this to those who are not, and perhaps in the end the equation of final with efficient cause is a concept which one either can or cannot accept, with no more to be

said (apart from the tracing out of its consequences, for good or ill, in Aristotle's system). At any rate I cannot here undertake the full discussion that this question requires. But one point may be made here in Aristotle's defence. It concerns certain absurd consequences of refusing to identify nature as a principle of change or development with nature in the sense of fully developed structure. Suppose that we refuse this, on the ground that the developing creature has one but lacks the other. It follows that when the creature attains developed form, it has a property which earlier it lacked. If this developed form is, as Aristotle always holds it to be, that in virtue of which the creature is a substance of the kind that it is, it follows that the still developing creature was not a substance of that kind. Either it was of a different kind, or it was no substance at all. In either case, it is impossible that developing and developed should be the same individual substance at different phases of its history, for the same individual substance must, for as long as it exists, be of a single individual nature throughout all changes (including development). But if developing and developed are not the same individual, the "developed" never did develop, and there is no such thing as development. The alternative, which is also absurd, would be to deny that the fully developed structure is an essential property of the creature which attains it. In that case, the developing creature lacked nothing in virtue of which the developed is the kind of substance that it is. But then what is the essential or substantial nature that was present throughout? The only likely candidate is the property of being a source of development (or developments) into such and such a description of structured object. This property is common to the developing and also to the developed (the latter being a potential parent of like offspring). This implies that

being endowed with a source of development into mature structure C is of the essence of the object, even though having C itself is not of the essence; from which it follows that the substance might itself cease to be characterised by C (e.g. the structure of a mature human being) while retaining the essential power of giving rise to developments towards C: thus what is no longer a man (of human structure) could nonetheless generate man. To conclude: if a developing thing is a substance of the kind it is on account of the principle within it of development, and if a developed one is of the kind it is on account of its fully structured form, then these two natures, *natura naturans* and *natura naturata*, must be and all along have been in some sense identical, or else the same individual substance has different substantial essences.

(21) Having supported Aristotle thus far in his identification of nature (= principle of change) with form rather than matter, let us now see how effective this is against the materialist position, and in particular against the second of the materialist positions distinguished in paragraph (10) above. This was the theory that the only real substances are the physical elements, while 'everything else' is only these elements in various 'affections, states and modifications'. Now the concept of "nature" which Aristotle has just developed combines (a): "nature" = a thing's typifying characteristics: with (b): "nature" = what it is about a thing that gets reproduced in growth and generation: and these two with (c): "nature" = the power of growth and generation. And his construction of this concept has not only been carried out without refuting the "elemental" materialists, but on the face of it does not even logically presuppose their

refutation. For it seems perfectly consistent to hold (i) that a thing has a nature in the complex sense just explained, while also holding (ii) that this nature, both the power of reproduction and the typical characteristics reproduced, derives entirely from the ways in which the basic components of the organism are, and are together, in it. And the conjunction of (i) and (ii) again seems perfectly consistent with the view (iii) that the component elements are as they are in the organism merely in the natural course of their own natural behaviour and interactions. If (ii) and (iii) are true, then the nature of the organism can be fully accounted for, scientifically, in terms of the natures of the constituents. But in that case, the organism is not, *qua* having its nature, a *per se* unity, and any organic behaviour resulting from its nature derives ultimately from a *per accidens* combination of mutually external factors.

(22) There is one possible explanation for the fact that in II 1 Aristotle does not even notice this as a threat to his position. It is that he has now developed a coherent and viable concept of "nature" which does not require that a nature should represent a metaphysical unity. As it stands, the concept that results from interweaving (a), (b) and (c) above is not only coherent and commands considerable support from ordinary usage, it is above all applicable to objects of experience. And it is not clear how this last advantage could be preserved, or the former ones enhanced, if we were to impose the further condition of *per se* unity. Now if the notion of "nature" which has just emerged does not include *per se* unity, Aristotle can still maintain his initial equation between "having a nature" and "being a substance" (*v.s.*

paragraph (6)) by (implicitly) relaxing the concept of "substance" so as to apply it to whatever in experience presents itself as a thing for ordinary purposes of description and identification, without any presumption of unity in an absolute sense. And in that case, the only part of the elemental materialists' position that Aristotle needs to reject is their claim that the simple bodies are 'the whole of substance' (v.s. paragraph (10)). To do this, he does not require a special argument to disprove their position, but only an account (which he has now given) of a sense of 'nature' from which it follows that 'nature' (and therefore 'substance') applies to some beings other than the simple bodies.

(23) However inviting this path (for the reasons indicated), Aristotle makes clear by the end of *Physics* II that it is not for him. This emerges beyond any doubt from his discussion of necessity in Chapter 9. He asks concerning necessity in nature:

'Is the necessary necessary on a supposition, or absolutely? I ask this because on the current view of necessity in [naturall] coming to be, it is as if one were to think that a house-wall had come into being by necessity because it is of the nature of heavy things to move downwards and of light things upwards, and therefore the stones and the foundations go at the bottom, the earth higher because it is light, and the wood at the top because it is lightest. But although it has not come into being without these, it is not because of them (except in the sense in which matter is a cause), but in order to enclose and protect. It is the same with everything else that has an end: they do not come into being without those things that possess the necessary nature, but these are not the cause, except in the sense in which matter is. The cause is the end: *e.g.* the question "Because of what is a saw like this?" gets the answer "So that such and such may result, and for the sake of such and such". But this end cannot come about unless the saw is of iron. So it is necessarily iron if it is going to be a saw and to function as one. Thus what is necessary is so on a supposition, but the end product is not necessary. For the necessity is in the matter,

whereas the end for the sake of which is in the formula. (199b34 - 200a15) It is clear that there is necessity in the natural world only in the sense in which "necessity" indicates matter and the changes of matter. The physicist must take account of both causes, the matter and that for the sake of which, but of the latter more than the former. For this is the cause of the matter, but the matter is not the cause of the end. The end is that for the sake of which, and the principle of a natural thing should be drawn from its definition and formula, as in the case of artificial products. Since a house is such and such a thing, these things must necessarily come about and be the case first, and since health is this, these things must necessarily come about and be the case first: so too, given that a man is this, then these, and if these, then those.' (200a30 - 200b4)

These passages occur after the discussion (Chapter 8) in which Aristotle takes himself to have shown that the organisation and behaviour of organisms and their organs can and ought to be accounted for teleologically. He now concludes that it is correct to say of an organism that it and its organs come about or are as they are by necessity only to the extent that the organism is made of certain materials which must necessarily be present and be disposed in various ways in order that there should be that organism. Only the matter and its states are necessary, and the necessary is only conditional. By thus confining necessity to the matter, Aristotle implies that the form, which is the end, is not only not necessary in the way in which the matter is (*i.e.* for a further end), but that it is not necessary at all, and therefore not a necessary consequence of the matter.¹⁸

18. M. Polanyi, 'Life's Irreducible Structure', *Topics in the Philosophy of Biology*, edd. Grene and Mendelsohn, pp. 128 ff. (originally in *Science* 160), calls the organism (or its form) 'the boundary condition', an expression well chosen to emphasise that the direction of necessitation is from form to constituents.

(24) Aristotle's immediate purpose in limiting the rôle of necessity in nature is to uphold teleological explanation. But the passage just quoted also shows that he is committed still to regarding beings endowed with natures as *per se* unities. He has not lost hold of this metaphysical concept, even though our examination of II 1 led us to wonder whether it might not get quietly forgotten. For the condition for predicating *per se* unity of a complex being is identical with the condition for applying teleological explanation as Aristotle understands it. This condition is that the properties and behaviour of the complex being are not wholly explicable as the product of a *per accidens* combination of simpler components and their respective behaviors. Once such explanation is shown to fail, it follows (a) that the complex being is something other than a *per accidens* combination and (b) that in order to explain the being's characteristics and behaviour something other than its components must be invoked. (It should perhaps be remarked that (b) alone does not entail that the new explanatory concept will necessarily be teleological. For 'teleological explanation', as ordinarily understood by philosophers, including Aristotle, implies not merely that the explanation is not mechanical, but also, positively, that it invokes the notion of a good. In practice however, whoever accepts (b) will almost certainly regard (b) as proving the applicability of teleological explanation, since no other type of non-mechanical explanation seems to have been envisaged.)

(25) In the last paragraph, I spoke of teleological explanation 'as understood by Aristotle'. The point was to indicate the difference between him and those philosophers who hold that the same phenomenon

can in principle be adequately explained both mechanically and teleologically.¹⁹ Sometimes, too, it is suggested that while a teleological explanation may be satisfactory as long as the knowledge is lacking to provide an adequate mechanical one, such knowledge is in principle available and once it is achieved, the teleological account should become a thing of the past, at least for the scientifically-minded. It was useful as a heuristic device only, a metaphor for facilitating the construction of mechanistic hypotheses.²⁰ However, Aristotle's treatment of the artifact examples in II 9 shows that for him an explanation of complex natural substances in terms only of the necessary behaviors of their component materials would be inadequate; inadequate, that is to say, not because such an explanation is as it stands sufficient, yet is not the only type of sufficient explanation, so that on its own it does not account for the phenomenon in all the ways in which it is possible to account for it: but because the nature and behaviour of the components are on their own insufficient to provide even one satisfactory explanation.²¹ In other words, for Aristotle the concept of "end" provides not an additional explanation, nor one that can eventually be dispensed with, but the only explanation of something additional (to the materials) in

19. For a discussion of this and related topics, cf. J.L. Mackie, *The Cement of the Universe*, pp. 276-284; for a tentative application to Aristotle, see Charlton, *op. cit.*, p. 93.

20. See e.g. W. Wieland, *Die aristotelische Physik*, (translated as 'The Problem of Teleology' in *Articles on Aristotle*, vol. I, edd. Barnes, Schofield and Sorabji), pp. 267-268: 'teleological explanation ... is a concept which *makes possible a more exact search for causes* simply by presenting itself as a *guideline* for the exploration of the particular'. (Author's italics.) For further references, see M. Grene, 'Aristotle and Modern Biology', *Topics in the Philosophy of Biology*, p. 7 (this article first appeared in *Journal of the History of Ideas* XXX). See also A. Gotthelf, *op. cit.* pp. 252-253.

21. Cf. Mansion, *op. cit.*, p. 340.

the phenomenon to be explained.

(26) We must now face the question whether Aristotle has any good ground for supposing that the form of an organism (and therefore also the principle that gives rise to the form considered as an empirically knowable structure) is causally extra to the matter. It is of course possible to distinguish conceptually between the shape of a thing and what is shaped, but this does not prove that what is thus shaped did not by the laws of its own nature come to be in that shape. This distinction can be made even for some mass of inanimate matter, say a lump of earth, yet Aristotle would certainly not attribute the shape in this case to a form that is somehow beyond the matter (his matter-form distinction cannot be made at all for the "simple" bodies: this is part of what he means by 'simple' in this connection). It might be objected that this example makes no point, since bits of earth can be any shape, which shows that the particular shape is not of the nature of a piece of earth as such, whereas what we are concerned with is organisms, which, within a given kind, always display the same morphology. But it could be answered that this difference tells, if at all, on the side of the materialists, since the very regularity with which an organic form recurs suggests causal dependence: and what is there for it to depend upon if not the physical constituents? We may begin to wonder whether Aristotle has not been enticed too far by his analogy with artifacts. More often than not (even in the *Physics*, but especially in the *Metaphysics*) he takes artifacts as illustrations of the distinction between matter and form. And we may be forgiven for suspecting that they are apt examples because they are the only ones. For in an artifact, by definition, the form is causally

extraneous to the matter, since that is why there was need of the artificer. In them too the form is contingent to the matter for the additional reason that the same artificial form can in many cases be imposed upon quite diverse types of matter: there can be iron as well as wooden bedsteads. Whereas Aristotle makes it clear that in natural substances the relation between form and proximate matter is not in this sense contingent. 'What always happens necessarily happens': so that if there are never trees of iron this is because there could not be. It is true that the fact that there could not be a tree except of a given type or types of material does not entail that such material must necessarily result in a tree. But the acknowledged dependence in one direction (no tree without woody material), which is not in general paralleled in the case of artifacts, suggests that he has not sufficiently investigated the possibility of dependence in the other direction too (no woody material of such and such a kind which is not necessarily in the form of a tree). The fact that this latter dependence does not hold in the case of artifacts cannot be used as evidence for its not holding in the case of natural substances. If natural substances differ from artifacts in respect of the former dependence then why not also in respect of the latter? And a similar argument could be based on another difference already examined in Chapter I, paragraph (31). A natural substance by contrast with an artifact not only requires a particular type of matter, but the principle which in any individual case brings the form to completion is so intimately related to matter that it can only operate on one particular material object, *viz.* the body of the individual itself, and no other.

(27) If Aristotle simply ignored these disanalogies between natural objects and artifacts in order to maintain that matter in the former case cannot account for form, we might reasonably accuse him of falling unawares into the Platonism he is resolute to avoid. For if the form neither springs from the matter, nor is imposed by a maker within the natural world, where can it be "from" if not some transnatural realm, or the mind of a divine maker? In fact, however, Aristotle seems to see himself finding an adequate alternative to such Platonism²² when he emphasises precisely those aspects of natural substance that indicate the immanence of form. And these are precisely the respects in which we have just seen the analogy with artifacts to break down. In short, our discussion so far has failed to show any way in which Aristotle could rebut the charge of taking up and putting down the analogy just as it happens to suit him. On the one hand, form in natural substance is regarded as causally extraneous to matter on the ground that natural substances are like artifacts; while on the other hand, natural substances must be held (on both *a priori* and empirical grounds) to differ from artifacts on precisely the points that enable us to say of an artificial form that it is causally extraneous to its matter. But if the analogy turns out to be useless to establish Aristotle's position (as set forth in II 9, and also in 3 and 7, where the final cause is presented as irreducible to any other kind of cause), the arguments of II 1 that we earlier reviewed are equally worthless. To point out that the structure of a thing, or that its developed state, primarily determine our concept of what sort of thing it is (and so of its "nature" in one sense), is

22. For his rejection of the Demiurge *cf.* *Metaph.* A 9, 991a20 - 23. See Wieland, *op. cit.*, p. 273 and D.M. Balme, *Aristotle's De Part. An. I and De Gen. An. I*, pp. 94 - 95.

not to show that this structure and development is not explicable by the laws of the component materials. And whereas Antiphon's formulation of materialism may have fallen to the objection that man generates man, this does not disprove the deeper materialist thesis that being a man and a generator of men arises solely from the properties of more basic materials in certain arrangements. Now if the position of Aristotle in II 9 has any serious foundation in argument, the argument must have recognised and met this deeper thesis. So Aristotle himself realises, for it is on this level that he reopens the issue of form as nature *versus* matter in Chapter 8, to which we must now turn.²³

(28) Having stressed in Chapter 7 the theory of the four causes, Aristotle now sees the necessity to defend this against an attack that threatens to demolish not only teleological explanation but also any basis for maintaining that a complex natural substance is more than a *per accidens* conjunction of its elements.

23. The present account, it will be seen, is at odds with D.J. Allan's remark, *The Philosophy of Aristotle*, p. 33; 'Since he does not assume the movement of inanimate matter to be governed by inflexible laws, he does not have to answer the question raised by modern exponents of vitalism and mechanism, *i.e.* whether these same laws can, without invoking new factors, be made to give a sufficient account of living organisms and their changes.' I accept the 'Since ...' clause, but it does not justify the conclusion drawn. Prof. Allan here seems to confuse 'mechanism' (which in the context means 'biological reductionism') with 'rigid determinism'. ('Mechanism' has another unwanted modern association, with the concept of matter as inert. Thus the latter-day mechanist may in effect be denying the reality of what Aristotle calls 'inner principles of change'. But this is hardly at issue between Aristotle and the Presocratics attacked in II 8. For neither side is matter inert in the Newtonian sense (*cf.* D.M. Balme, 'Greek Science and Mechanism I and II'. *Classical Quarterly* XXIII and XXV, 1939 and 1941). But there still is room for a reductionist controversy. *Cf.* paragraph (42).)

'Now we must explain, firstly, that nature is a final cause, and secondly the place of necessity in natural events. For everyone refers things to necessity as a cause, saying that since the hot and the cold etc. have such and such natures, such and such things exist and come to be, of necessity. For if they mention another cause, they only touch on it and let it go - Love and Strife in one theory, Mind in another. But there is a problem: what objection is there to holding that nature does not operate for an end, nor because it is better so, but instead is like the rain, which does not fall in order to make the corn grow, but of necessity? For what has been driven up must get cooled, and what is cooled turns into water and must come down: and it is an incidental result that the corn grows. Similarly, if someone's corn is spoiled on the threshing floor, the rain does not fall in order to spoil it, but this has happened incidentally. So what is the objection to saying that it is the same with the organic parts of natural substances: of necessity the teeth come up with the front ones sharp and fit for tearing, and the molars flat and useful for grinding the food; since they do not come into being for the sake of that end, but happen to appear together? And similarly with all the other parts in which there appears to be an end. Thus in the cases in which all the parts came together as if it was for an end that they came to be, the organisms survived, being spontaneously composed in a suitable way. Whereas wherever this was not the case, they perished, and still perish, as Empedocles says of the man-faced oxenkind. This and any similar arguments might present a difficulty [*sc.* to the teleologist]. But it cannot be as they say. For these things and indeed all things that happen by nature either always come about in the way they do, or for the most part, whereas this is not true of any of the things that come about by chance or spontaneity. For we do not think it due to chance or coincidence if it rains often in the winter, although we do if this occurs in August; nor do we think it of heat-waves in August, though we would of heat-waves in the winter. If then it is agreed that "by coincidence" and "for an end" are the only alternatives, and if these things cannot be either by coincidence or by spontaneity,²⁴ they must be for an end. But all such things are by nature, as the holders of the theory themselves would agree. So "being for an end" applies to things that come about and exist by nature.' (198b10 - 199a8)

24. He is using 'by coincidence', 'by chance' and 'by spontaneity' as synonyms.

(29) Aristotle begins by preparing what seems an easy victory for himself. He attributes to his opponents a position that appears to be needlessly incoherent. He depicts them as holding that complex organically useful phenomena such as the set of teeth occur both by the necessary workings of the laws of their primitive components (the hot and the cold, etc., 198b13-14), and by "coincidence" ('συμπεσεῖν', 198b27, and 'ἄπὸ συμπτώματος', 199a1). Yet these, we might well object, are two very different positions, although both alike exclude Aristotelian teleology. It seems obvious too that whereas the first is reasonable and accords with the spirit of science, the second cannot be so described. Serious opponents of finalism would surely take their stand on the former ("necessity"), and would neither need nor wish to assert the latter ("coincidence"). Yet it is only against the second that Aristotle directs his reply. The reply then seems based on an *ignoratio elenchi*, or at any rate on an *ignoratio* of the genuinely challenging core of the proposed theory, however confused its actual formulations by Empedocles and the others. But this objection to Aristotle betrays anachronistic misunderstanding. If we assume that "necessity" (*i.e.* "causal or natural necessity") and "coincidence" offer necessarily different and even contrary accounts of the same phenomenon, this is because we are obsessed with the relatively modern problem of how to distinguish a causal or naturally necessary sequence of events from an accidental succession. For clearly the proposition that A caused B entails that B did not simply happen to happen after A. Thus we may think that no coherent theory could combine necessity with coincidence in the way in which Aristotle presents his opponents as doing. And since we are unlikely to believe that the only alternative theory to Aristotelian teleology is just such an incoherent amalgam of necessity and coincidence, we may well

conclude that knowingly or not, Aristotle is misrepresenting the opposition.

(30) We shall see later whether this charge is a fair one. But first it must be said on Aristotle's side that he is not at all concerned with coincidence as a property of successions or sequences of events, or as implying absence of causality between earlier and later. He is not for instance saying that his adversaries suppose that the growth of the teeth is causally unconnected with any causal antecedents - a view which of course they did not hold. He is here using 'coincidence', and also 'by chance' (199a1) and 'by spontaneity' (198b30, 36) to refer (a) to a group of simultaneous phenomena each of which has an independent antecedent cause, and (b) to a (desirable) outcome of the "co-happening" of such a group. (This is the gist of his own analysis of chance and spontaneity in Chapters 5 and 6 of Book II.) In this sense, "coincidence" is fully compatible even with universal causal determinism of later by earlier. For 'coincidence' means only that the result represents a convergence of mutually independent diachronic causal lines. Empedocles and the other *physikoi* are therefore portrayed by Aristotle as saying that organisms and their complex organic parts have come about through sets of independent causal processes involving separate material factors which behave and undergo transformation by the necessity of their own natures (*cf.* 198b12 - 14), and which merely happen to occur together, since none occurs because any of the others do, or through the same cause.²⁵

25. On this and the preceding paragraph see W.K.C. Guthrie, *History of Greek Philosophy*, vol. II, pp. 163 - 165 and 414 - 419.

(31) Aristotle's statement of the theory he is opposing is not then logically incoherent, as at first it might have seemed, but even so he appears not to do his adversaries justice. This emerges from his reply, where he argues (a) that the phenomena to be explained cannot be regarded as happening "by coincidence", and (b) that given that it is agreed ('δοκεῖ', 199a3) that they are either "by coincidence", or "for an end", they must be "for an end". Now Aristotle's reason for (a) is that we regard only exceptional phenomena as coincidental (in the sense explained), and that biologically useful conjunctions of organs and parts of organs are not exceptional. On this, he can appeal to the common-sense reaction to regularities of conjunction: if a conjunction regularly recurs, we take this as evidence of a common cause, which accounts not only for each conjunct severally, but also for their togetherness. And indeed the materialists can hardly have supposed that the teeth and other organs are "together", forming an animal, through the entirely independent workings of separate causal lines. Why should Aristotle have imagined that they did think this, or that their position entailed it? The entailment does of course hold given Aristotle's premiss (b), but why should he have thought that anyone not already convinced of the need for teleology would accept (b)?²⁶ Granted that it is unreasonable not to suppose a common cause for phenomena regularly conjoined: but why should this cause necessarily consist in a common end? It might also be granted that if a regular conjunction regularly contributes to some good result, a satisfactory explanation of the regularity should make

26. Cf. H. Cherniss, *Aristotle's Criticism of Presocratic Philosophy*, pp. 251-252. Cherniss attributes Aristotle's failure to recognise mechanical causation to a sheer inability to step outside his own conceptual system. Wieland, while more sympathetic, makes essentially the same point, *op. cit.*, pp. 260-261.

some reference to that good. But the materialists are not logically committed to denying the relevance, in an explanation of the set of teeth, of the fact that the set is useful (while its members would have been individually useless). Empedocles at any rate believed that he could do justice to our sense that such a denial would be absurd or unreasonable, without resort to a teleological account. Because such and such independent natural processes occurred, a particular fortunate conjunction came about, and being useful it (or rather the organism in which it occurred) survived, and reproduction together with the non-survival of non-viable conjunctions saw to it that conjunctions of this useful type became the regular thing. Aristotle's insistence that what happens regularly cannot be by coincidence seems crudely to miss the point of the Empedoclean account, which implicitly distinguishes between past and present infrequency, and between infrequency of types and of instances. The types of conjunction that are viable are few by comparison with all possible types, and also by comparison with all the types that have ever been actually instantiated. The original instances of viable types of conjunction were probably infrequent by comparison with contemporary instances of non-viable types. But the present instances of the viable types are for obvious reasons vastly more frequent than their non-viable contemporaries. Thus in one sense the set of teeth (and the animal it belongs to) is exceptional, in another sense not. There is no contradiction here, but a coherent (even if rather quaintly illustrated) theory, and one which does without teleology.

(32) If Aristotle fails to notice how the concepts of frequency and infrequency operate on different levels in this account, it may not surprise us that he commits what seems another obvious mistake: that of transferring the concept of "coincidence" as applied to the original coming together of elements to form a viable combination, to their remaining together in this combination, and also to the subsequent togetherness of similar components in creatures descended from the original viable one. He seems to think that the opposition are committed to holding that because the original coming together (which may have occurred in very few cases) was a coincidence, the same is true of the subsequent staying together, and also of the consequent being together of similar components in the offspring. Just as the original conjoining was due to the mutually independent behaviour of different objects, so the continuing existence of the resultant combination is due to nothing more: each constituent stays with the others by being and behaving just as it would even if they were not present. On this view, the only kind of explanation for the combination's continuance will be a conjunction of explanations each showing how a given component came to be and still is where it is. This is the Empedoclean case as Aristotle construes it, and it looks like a straw man of his own making. Everyone would agree with Aristotle's rejection of this account, insofar as rejection implies belief in some connection between the factors in the stable and self-reproducing compounds: a connection warranting explanation in terms not reducible to a mere conjunction of independent causal stories. But Aristotle goes further: he assumes that the materialists could indicate no connection except a teleological one: the factors are and remain together in order to maintain a useful whole. Yet to us it seems obvious that they could have held the connection to lie in the

natures of the factors themselves: that these stay combined because they are such as to interact to form a stable whole - which latter is the result but not the end. It results because the factors, once together, affect each other in such a way that they cohere. But it need not be supposed that when together they are as they are and behave as they do in order to cohere, any more than that when apart they behaved as they did in order to come together, or from any cause other than the necessity of their natures.

(33) No doubt the materialists' ideas as to the actual specific workings of combination in given types of case were nebulous almost to non-existence. Does Aristotle the philosopher then rest his refutation on nothing more than their inability to give convincing empirical content to an *a priori* position? Or is it that he takes 'Either by coincidence or for an end' to be some kind of conceptually necessary universal truth? Hardly this, since he himself does not treat the dichotomy as exhaustive.²⁷ He is willing to concede propositions such as 'what is driven up must get cooled, and what is cooled turns into water and must come down' (198b18 - 20), being well aware that these 'musts', in his opponents' mouths, do not signify his own (as yet unproposed) concept of 'necessary-for-a-given-end' (v.s. paragraph (23)), but the "brute" necessity that excludes finality. Nor on the other hand did Aristotle think that these elemental motions and transformations occur "by coincidence": They come about through the intrinsic natures of the substances concerned (air or fire, and water), and (unlike the spoiling of the corn) they do not depend on

27. Cf. Charlton, *op. cit.*, pp. 120 - 121.

the accidental occurrence of some special external circumstance (as *e.g.* that the corn happens to be laid out just where the rain falls). Such occurrences, then, he admits (or admits for the purpose of the argument)²⁸ are neither by coincidence nor for an end, but as we should say, by a law of nature. But given this recognition of a *tertium quid* between "by coincidence" and "for an end", how can he be so certain that it does not apply to organic phenomena?

(34) Unfortunately Aristotle does not answer this question himself, nor even indicates having given it a moment's thought. This is because from his point of view, as I shall now argue, it hardly deserves serious consideration. First it must be stressed that in this discussion Aristotle regards the onus of proof as lying with the materialists. This is clear from the fact that he has already (Chapters 3 and 7) propounded, without demonstration, his own doctrine of the four distinct types of cause. No doubt his confidence is partly a Platonic legacy. But that 'the teeth are for chewing' etc. would also have seemed (perhaps still seems) plain common sense. Furthermore, empirical investigation itself shows that at least in one field of natural phenomena the systematic and detailed application of teleology results in hypotheses that are clearly statable, empirically

28. It seems that most writers take Aristotle's teleology to apply to all types of natural substance, including the simple bodies. See in particular Balme, 'Greek Science and Mechanism I', *loc. cit.*, pp. 129 ff. This view is challenged by Charlton, *op. cit.*, p. xvii, and Gotthelf, *op. cit.*, p. 237, note 19. It is not clear how far there is real disagreement, since Aristotle did not always recognise the simple bodies as substances (*v.s.* paragraph (6) and note 5). Aristotle need not share the Empedoclean view that the descent of rain etc. is not for an end. He concentrates on the end-directedness of organisms because they are the most obvious examples, not necessarily because they are in his view the only ones.

verifiable, and very frequently also confirmed: whereas materialism at the time could claim no corresponding scientific success, nor did it suggest any definite method for achieving it.²⁹ Thus Aristotle does not see himself as obliged to argue against the abstract proposition that 'Nothing in nature happens for an end', but only against a particular proposal to this effect. The proposal in question is a reductionist thesis, as is clear from the second sentence of Chapter 8. Complex organic phenomena come about by ("brute") necessity because they are reducible to simple phenomena which everyone would agree occur by necessity. It may be that there are coherent denials of final causation which involve no reductionism. But Aristotle is not concerned to refute wholesale every possible denial of what to him is *prima facie* obvious, and if he can deal with the problem in the form in which it had actually to date been posed, this is all that he needs to do.

(35) The simple phenomena on which the proposed reduction is based are "the hot and the cold", and the physical substances, fire, earth, etc. which are the primary bearers of these qualities. But for Aristotle the fundamental natures of such substances are expressed by motions in different directions. Apparently Empedocles for one did not disagree.³⁰ In *De Anima* II 4, 415b28 - 416a2, Aristotle says:

'Empedocles is wrong in adding that growth in plants is to be explained as follows: the downward

29. Cf. Balme, *Classical Quarterly* XXXV, p. 28, Wieland, *op. cit.* pp. 267 - 268.

30. Although his view, like that of Anaxagoras, is based on "like to like", not on "natural place". This difference from Aristotle does not affect the argument.

rooting by the natural tendency of earth to travel downwards, and the upward branching by the similar natural tendency of fire to travel upwards.'

Aristotle has two objections to this explanation, the first being that it disregards the functions of the plant's parts: functionally, the roots correspond to the head of an animal (both contain the organs of ingestion). Presumably Empedocles would explain the upward growth of a head by the tendency of its main constituent element to travel upwards: thus phenomena which from the functional point of view demand the same type of explanation, are for Empedocles instances of opposite tendencies. To this, Empedocles might reply that it is begging the question against him to insist that he be concerned with explanation in terms of function. But Aristotle's second objection meets him on his own terms:

'Further, we must ask what is the force that holds together the earth and the fire which tend to travel in contrary directions: if there is no counteracting force, they will be torn asunder ...'
(416a6 - 8)

Clearly, if there is a counteracting force, it does not stem from the nature of any extra material element: for Aristotle, every element is necessarily characterised by locomotion in a specific direction; so that far from countering the "aliofugal" tendencies of earth and fire, anything else of the same type would simply add its own such tendency to the situation.

(36) Against this theoretical background, which Aristotle's opponents themselves do not reject, the materialist programme of reducing organic phenomena to the processes of their simple inanimate constituents must have appeared a hopeless fantasy to anyone who saw clearly the issues involved. Certainly there are no mechanical principles that

could hold the components in a structured unity, and even the absurd suggestion that (in repeated instances) they are together because they happen to be together implies a physical impossibility. When the nature of a simple substance is to move in a single simple direction, how could masses of even one such substance (let alone more than one) retain (if they could fall into) arrangements resembling even the most primitive organic structures? Even "coincidence" could not account for the phenomena, so that in saddling his adversaries with a coincidence-theory as their only alternative to teleology Aristotle actually allows them more than they deserve. Or are we perhaps overstating the case against them? Not, it seems, if we suppose that they suppose the simple elements to be present in the compound by way of mechanical synthesis. But we ought also to consider whether the notion of chemical combination might not serve them better.

(37) Aristotle distinguishes between two types of combination,³¹ (i) synthesis, which gives rise to a mere spatial aggregate of different objects (ears of wheat mixed with ears of barley); and (ii) mixis, in which the simple bodies combine to form a homogeneous substance with different properties from those of its components. This is his closest approach to our distinction between mechanical and chemical combination, but his concept of a "mixtum" is nonetheless very different from our idea of a chemical compound. We conceive of a quantity of some chemical compound as consisting of qualitatively identical ionic agglomerates or molecules each of which is a structured system made

31. On this topic see *De Gen. et Corr.*, I 10, II 6-8; H.H. Joachim, 'Aristotle's Conception of Chemical Combination', *Journal of Philology* XXIX, 1904, pp. 72 ff.; the same author, *Aristotle on Coming-to-be and Passing-away*, pp. 175-189, 230-246.

up of "atomic" components, themselves in turn structured. An atom of a given substance (element) E is seen as a unit having just that structure or internal configuration that would enable it to combine (by electrical attraction) with atoms of other elements to form all the known compounds of E. There is a sense in which an atom of E in some compound cannot be described in exactly the same terms as an uncompounded atom of E. Thus, *e.g.*, in the compound, the outermost electrons of the E-atom relate not only to the nucleus of this atom, but also to the nucleus of another - hence the compound; whereas when E is uncompounded, its electrons relate only to its own nucleus. All the same there is an isomorphism between the compounded and the uncompounded E-atom, as between a one-inch square drawn on its own and a one-inch chequerboard square (which shares its sides with other squares), that makes it legitimate to say that the E-atom is present in the molecule or ionic agglomerate. (Moreover the nucleus and inner electronic shells of the atom are not affected by chemical change: which seems to entail that they are present in the compounded and the uncompounded atom in just the same way.)

(38) All this is alien to Aristotle. For him, a compound ("mixtum") of simple substances is through and through homogeneous, not only in the sense that physical division never reaches a part that does not have the same observable properties as the larger mass, but also in the following sense: the mixtum cannot from any point of view be regarded as structured, or as consisting of structured units (like molecules) that are systems of "interlocking" component factors. This view of the nature of a compound may rest in part on the difficulty of seeing how a structure of "interlocking" components could differ

from a mechanically conjoined aggregate: in the absence of some account of the special nature of a chemical bond,³² the original distinction between synthesis and mixis would be threatened. But the path towards any theory of compounds as structured is for Aristotle even more fundamentally blocked by his own conception of the simple elements as essentially characterised by locomotion in a given cosmic direction. It follows from this conception that compounds cannot be regarded as consisting of elemental particles that actually instantiate in full the same essential nature as uncompounded particles of the same elements, nor therefore the same nature as they themselves instantiated prior to entering the compound. Such a situation would imply that the compound was either so unstable as never to exist at all for any span of time, or that it was held together by a continuing miracle. We might conclude that Aristotle's doctrine of the elements simply cuts him off from the concept of a compound altogether, and in our sense of 'compound' we should be right. Yet Aristotle himself does distinguish between mixis and synthesis, and what is more, he holds that mixis produces those stuffs that are the immediate matter of the organic parts of organisms: flesh, bone etc. These are homoeomerous compounds of all four elements in varying proportions. But how can he even coherently conceive of such stuffs? Only by dispensing with the assumption that the elements that make up a compound are actually present in the compound once formed. The compound is actual only when its components (the elements) are not

32. Cf. Joachim, *Aristotle on Coming-to-be, etc.*, p. 183: 'The reader will observe that $\mu\acute{\iota}\xi\iota\varsigma$, as Aristotle conceives it, demands a more thorough union of the constituents than that assigned to the constituents of a chemical compound by modern chemical theory. In so far at least as modern chemistry regards a compound as a mere arrangement or shuffle of the atoms of the combining constituents, Aristotle would accuse it of confusing $\mu\acute{\iota}\xi\iota\varsigma$ with $\sigma\acute{\upsilon}\nu\theta\epsilon\sigma\iota\varsigma$.'

fully actual. But this is not to say that they in no sense are, or that they are destroyed out of all possibility of existence when they form the compound, for when the compound exists actually, they are present potentially, in that the compound can be transformed back into the separate elements.³³

(39) Only in this way does Aristotle achieve a concept of "chemical compound" that is not logically at odds with his ascription of essentially locomotory natures to the elements when "freestanding". The solution is not without its difficulties, however. To mention only one, it is implausible to hold that a compound wholly lacks the locomotory characteristics of all its elements. Flesh and bone have weight, *i.e.* tend towards the centre, like earth their major component. And how is this to be explained except on the supposition that earth is not totally absent, *i.e.* not merely potentially present in the sense in which 'being potentially F' is compatible with the total absence of the corresponding actuality? A good craftsman builds taking maximum account of the continuingly actual forces of the primitive components,³⁴ and the stability of the finished product depends as much upon their presence as upon the balance which if left to themselves they could never have achieved. How can something like this not be the case with natural complex structures such as organisms and organs? But if this is so, then standard senses of the formula

33. Cf. Joachim, *loc. cit.*, Cherniss, *op. cit.*, pp. 140 - 143; L. Robin, *Aristote*, pp. 138 - 139; S. Sambursky, *The Physical World of the Greeks*, p. 144; E. McMullin, 'Four Senses of Potency', *The Concept of Matter in Greek and Mediaeval Philosophy*, ed. McMullin, pp. 305 - 308, 315 - 317; E.J. Dijksterhuis, *The Mechanisation of the World Picture*, pp. 23 - 24 and 200 ff.

34. *E.g.* of the housewall in II 9, 200a1 ff., quoted paragraph (23).

'potentially but not actually present' cannot do justice to the fact that the independent natures of the four elements are not totally "suspended" in flesh, bone, etc., but are permitted limited expression, the bounds of which are set by requirements of organic functioning.³⁵ Thus the earth-composed roots of the plant tend sufficiently downwards to give it necessary stability, but not so as to part company with the other organs, thereby ceasing to be roots.³⁶ But we need not reach a decision on how precisely to conceptualise the status of the earth in this example in order to see that for Aristotle there can be no question of explaining the structure and behaviour of organisms and organs by reference to the properties of their simple components. The reductionist programme presupposes that a knowledge of the independent natures of the components (*i.e.* of laws concerning them which have been established independently of the organic context) would, given known boundary conditions, make it theoretically possible to predict organic structure and behaviour. But we now find that the elements "in" the organic context either totally lay aside their original natures or modify them so as to fall in with the needs of the whole. On the first alternative they are not actually present at all in the organism, so that it would be absurd to attempt explaining it and its behaviour, which are actual, by reference to the non-actual properties of the non-actual. On the second alternative, while the elements may

35. Cf. Joachim, *Aristotle on Coming-to-be, etc.*, pp. 180 - 181 and McMullin, *op. cit.*, p. 306. For the later history of the problem see Dijksterhuis, *op. cit.*, pp. 200 ff.

36. Many writers find irresistible the metaphor of the organic form 'compelling', 'constraining', 'bending', 'harnessing', the behaviour of the materials. This wrongly suggests that the latter are present in the full actuality of their independent natures so as to need repressing. If a metaphor is needed 'voluntary self-subordination' better describes the normal case. Or: the well-functioning organism is to its matter as the σώφρων to his passions, as opposed to the ἐγκρατής.

in a sense be there, the ways in which they manifest their presence are deducible only from a prior knowledge of the organism and its requirement, not *vice versa* as the reductionist would have it. The whole, moreover, is inexplicable not only in terms of its simple ultimate components, the four elements (this answers what we earlier called the second materialist position, *v.s.* paragraph (10)), but in terms too of its immediate materials, the homogeneous compounds (which answers the first position). For these, being (as they must be) absolutely free of configuration at any level of analysis, could never alone explain organic structure and the functioning that depends on and maintains structure. Such is the basis of Aristotle's position in *Physics* II 8, and insofar as the materialists share his view of the elemental locomotions, they too are bound by its consequences.³⁷

37. Through lack of space I have taken no account of Aristotle's explanation of elemental combinations in terms of the four contrary powers and their combinations in the simple substances and compounds of these. This topic raises fundamental problems, not least that of the conceptual relationship between the theory that defines fire etc. as Hot-Dry etc., and that which defines them by reference to natural places. Has Aristotle his own version of the wave/particle problem? See F. Solmsen, *Aristotle's System of the Physical World*, pp. 363-364. But I do not see that a full discussion would affect the present argument. The theory of contrary powers is supposed to explain (a) the mutual transformation of the simple bodies, (b) their transformation into mixta with different properties from the components'. But it does not allow us to say that *e.g.* Fire (= Hot-Dry) is actually present in a mixtum. For Hot and Dry are supposed to have merged with their opposites contributed by other elemental components, so as to form a new intensive property. The λόγος of a given type of mixtum refers to the proportions of the elements that went into it, but (unlike a modern chemical formula) not to any actual resultant structure in which, say, 2 discriminable units of fire are bonded with 3 of earth, 1 of water, etc. Thus the introduction of the contrary powers leaves us as far as ever from being able to explain the structural properties of an organic whole by reference to its constituents.

(40) So in a modern discussion of mechanism *versus* teleology there is no point of entry for Aristotle. This debate gets off the ground by means of considerations such as these:

'The physical sciences are concerned with a hierarchy of structure and patterns resulting from very different processes: the fusion of the fundamental particles within the nucleus of the atom; the association of various numbers of electrons with atomic nuclei of different net charge to produce over 100 different elements; the combination of these elements to produce millions of different chemical compounds; the interaction of elements, compounds and energy in various forms to make the large scale features and phenomena of the natural world, mountains and seas, stars and planets, storm and earthquake. Living organisms continue to persist in the world by imbibing less organised material from outside (in respiration and feeding) and when they cease to exist their organization breaks down into chemical compounds such as salts, carbon dioxide, ammonia and water which are structurally not different from those obtained by mining, combustion, or the synthetic processes of chemical industry. It seems therefore legitimate, and a reasonable *prima facie* assumption on which to base further study, to regard living organisms as matter organised in a special manner, and not as matter invested with a special property "life" beyond the scope of the physical sciences.'

(A.R. Peacocke, in 'The Molecular Organization of Life', in *Biology and Personality*, ed. I. Ramsey, p. 17.)

So many things are 'matter organised in a special manner', so why should not the same be true of living things?³⁸ This is where the controversy starts between the modern mechanist and the "emergence" theorist, or between reductionists and organicists. But for Aristotle the fundamental problem occurs a long way back: How can inanimate matter be organised at all? Living things, from this point of view, are no more surprising than inorganic compounds: in a way less so, for whereas the character and behaviour of the former can be explained

38. Cf. also H. Hein, 'Molecular Biology vs. Organicism', *Synthese* XX, 1969, p. 242: 'The molecular biologists claim ... that the dynamic, system building character of organisms can be accounted for in terms of a basic architectonic tendency inherent in the fundamental particles of matter itself.'

teleologically, those of the latter cannot, nor by reference to the behaviour of any actual constituents either.

(41) I have argued that within the framework of his theory of the simple bodies, Aristotle's refutation of contemporary materialism in *Physics* II 8, 198b10 - 199a8, can be seen to be cogent. It follows (within this framework) (a) that there is a sound basis for applying teleology to at least some natural phenomena, and (b) that organic creatures can properly be regarded as ontologically fundamental substances in their own right, rather than arrangements of other, physically more primitive, substances. They are, in other words, *per se* unities. This conclusion does not make it illegitimate to say that they are also combinations of components. In the first place, they have organic parts, both the structured organs and the various homoeomerous stuffs such as flesh that the organs are made of. But these are not self-sufficient substances having each its own inner principle of change which it exhibits in actual change whenever not physically prevented. That would imply that even (if not especially) when separated from the organic context the objects in question would change naturally so as to express autonomous natures. But in fact organs and flesh etc. are never found except in the organic context, or if separated they begin at once to decay. Thus although the organic whole is in a sense a combination of them, it is not a *per accidens* combination of substances. Secondly, the organic whole does in a sense consist of the simple bodies, and these are indeed autonomously natured substances (at least in the *Physics* they are so treated). But they, unlike the flesh and organs, are not actually present in the organism, *i.e.* not as autonomous beings. Hence the organism, which is

actual, cannot be viewed as a *per accidens* combination of them either. The *per se* unity of the whole is not diminished by its being composed of different things, for the actually present components are not substances, while the substantial components are not as such actually present.

(42) Despite the close relation between conclusions (a) and (b) above, they are distinct. This is clear once we realise that so far as (b) is concerned, it makes no difference to Aristotle's argument whether the materialists view the simple bodies as necessitated to behave as they do, or as meaning to. They may or may not have thoroughly disengaged these two concepts from one another: the English word 'will' itself bears witness to a proto-concept in which the ideas of purpose and of predictability as such had not yet parted company. 'By necessity' and 'for an end' express opposing concepts only when the latter is applied to creatures that act for more than one end, or that do not always achieve the same end in the same way. Thus even if we say that earth falls in order to be at the centre, it remains true that it must fall, since for earth there is no other end and no other way of getting there. Suppose, then, that the materialist notion of the necessary movements of the elements was not wholly untinged with teleology (in which respect it would probably have resembled Aristotle's own). In that case there would be no need for Aristotle to prove that some phenomena are teleological, since this (by the supposition) has never been clearly denied by either party to the controversy. Aristotle would therefore be wasting his time in arguing in II 8 for a teleological account of organic structure and behaviour, if his only purpose in so arguing were to show that

teleology has application to nature. But his purpose, I suggest, is also to refute those who in II 1 were described as holding the simple bodies to be 'the whole of substance, and everything else to be affections and states and arrangements of these'. This position is compatible with a theory of goal-directed simple bodies. It may also be compatible with a theory of organisms as goal-directed. But it is not compatible with viewing organisms as genuine substances in their own right. From this point of view, the importance of Aristotle's argument in II 8 does not lie in the bare conclusion that organic phenomena are teleological, but in the proof that they cannot be explained as combinations of simple substances. The proof is the same whether we think of the latter as having wills of their own, or as necessitated in some more clinical mechanist sense. Either way, "coincidence" would be the only cause of combination; and either way, combination would mean one of two alternatives: totally unstable synthesis or totally unstructured mixis.

(43) A number of writers have stressed the empirical basis of Aristotle's philosophy of organic substance. I refer in particular to a strong statement by A. Gotthelf,³⁹ who has shown clearly how Aristotle's teleology of organisms depends on a theory of the irreducibility of their behaviour to that of inanimate components.

'Philosophers of science today are in increasing agreement that the question of reduction is an empirical one; they insist that one cannot legislate the precise form of the laws in which our understanding of nature is expressed. Aristotle's attitude is

39. *Op. cit.*, pp. 253-254. With this passage compare F.S.C. Northrop, *Science and First Principles*, p. 18. See also A.P.D. Mourelatos, 'Aristotle's "Powers" and Modern Empiricism', *Ratio* IX, 1967, esp. p. 97.

similar: he does not attempt to legislate a priori the particular form which a successful account of the natures and potentials of living organisms must take. His arguments for his teleological doctrine make this clear. What he insists is that the facts as we have observed them, and the identification of the natures and potentials of things that these observations have led us to, entail the irreducibility thesis which is at the core of the concept of final causality asserted to obtain in nature. Though the simplicity and the non-mathematical character of Aristotle's chemistry (and physics) eliminates for him any real possibility of a successful reduction to element potentials [*i.e.* to the natures of the simple substances] of the complexities of the organic world, this makes his thesis no less empirical - for his view of the inanimate world is equally subject to revision. There is nothing in the fundamentals of Aristotle's philosophy, and nothing in his philosophical or scientific method, that would prohibit the adoption of a reducibility thesis, should the scientific evidence be judged to warrant it.'

The long tradition of bitter attacks on Aristotle as arch-enemy of the true spirit of science may still have life enough in some quarters to merit sharp reaction. But Mr. Gotthelf's defence of the "empiric Aristotle" (an image whose increasing vogue parallels that of "Aristotle the philosopher of ordinary language") is exaggerated.⁴⁰ It is true that observation supports the theory of elemental locomotions, as well as the distinction between aggregates and homogenous compounds. But observation could not teach Aristotle that the latter must be absolutely homogeneous, any more than it could dictate that the elements themselves must be simple. (This could be deduced from the teleological consideration that a substance whose nature it is to move straight up or down does not need to be anything more complicated than a homogeneous mass.) In general, observation may have seemed to

40. I agree however with the bulk of Gotthelf's article (unread when most of this chapter was written), and have found in it encouraging confirmation of a number of points made here.

confirm, but it could not enforce,⁴¹ the conception of a world of substances whose natures are expressed each in some single pattern of behaviour to which external objects are relevant only negatively as possible hindrances. This view, developed as it is by Aristotle, leaves no conceptual room for a view of basic physical units whose character is shown in and through all their specific combinations. Thus chemistry and biochemistry as we understand them have no beginnings of a purchase. One of the recurrent themes in Aristotle is conceptual pluralism.⁴² We have in logic the mutually irreducible categories, in metaphysics the four types of cause, in logic of science the autonomy of subject-matters. His philosophy of nature adds a striking example to the list: there is no single sub-class of laws from which all other laws and generalisations could theoretically be deduced. The four elements are all-pervasive, but they cannot account for living structures, and in each type of case the explanatory gap is filled by a different form or telos, of which there are as many as there are species of organism. To exchange this view for a reductionist alternative, Aristotle would have had radically to alter 'the fundamentals of his philosophy'.

41. Cf. J.D. Logan, 'The Aristotelian concept of $\Phi\Upsilon\Xi\Lambda$ ', *Philosophical Review* VI, 1899, pp. 18 ff., esp. pp. 32-33; 'The Aristotelian Teleology', *ibid.*, pp. 386 ff., esp. pp. 392 ff.

42. Cf. G.E.L. Owen, 'The Platonism of Aristotle', *Proceedings of the British Academy* L, 1965, pp. 125 ff., esp. pp. 140 ff.

CHAPTER III

The Definition of Change

(1) Having examined the concept of nature as a principle of change, we turn now to change itself.

'Since nature is a principle of process (κίνησεως) and change (μεταβολῆς) we must determine what process is. For if we do not know this, then we cannot know what nature is either. And having defined process, we must try to deal in the same way with the concepts next in order. Process is held to belong to the class of continuous things, and the infinite makes its appearance first and foremost in the continuous. For this reason, when people define the continuous they often bring in the concept of the infinite, saying that the continuous is what is divisible to infinity. Moreover, it is held that there cannot be process without place and void and time. Thus it is clear that for these reasons, and because these are common and universal to all [*sc.* physical] things, we must take each of them up for discussion, since inquiries into specific topics cannot precede inquiry into common concepts. So first of all, as we said, we must examine process.' (II 1, 200b13 - 25)

(2) On the principle declared in the last sentence but one, we might suppose Aristotle to be undertaking the most general and comprehensive enquiry into change. Yet the very wording of his preamble might also cause us to doubt this. In the first line he uses 'μεταβολή', his most general word for 'change'. But he uses it as interchangeable with 'κίνησις' and similarly a few lines below (200b32 - 33, 201a2, 8 - 9). In *Physics* V 1 Aristotle distinguishes the two terms, assigning to 'κίνησις' a narrower meaning.¹ This somewhat technical distinction we should not expect him to be observing here at

1. 'Κίνησις' is there applied only to non-substantial change.

the outset, and nor does he. Here in III 1 we find him using 'μεταβολή' to cover changes ruled out by the meaning stipulated in V 1. Even so, it is surprising that prior to any discussion he should treat the terms as interchangeable, since in their ordinary senses too they are not equivalent. Briefly, 'μεταβολή' means change from one state of affairs to another (cf. V 1 224b35 - 225a2), while 'κίνησις' implies or even means 'process'; and to describe an event as a change from one state to another is not necessarily to describe it as a process. So is Aristotle here using 'κίνησις' to mean the same as 'μεταβολή', the wider term, or is it the other way round? And what are we to make of the fact that despite the apparent equation of the two, he shows in the subsequent discussion an overwhelming preference for 'κίνησις'?²

(3) Aristotle's use of 'μεταβολή' expresses his determination to let nothing that could be called change from one state to another fall outside the net of the definition he is about to propose; whereas 'κίνησις', creeping in from the first and soon taking over, is symptomatic of a restriction controlling his entire approach to the concept of change. A few lines below the passage quoted above, and just before Aristotle proposes his definition of μεταβολή/κίνησις, he tells us insistently that changes are to be exhaustively classified in terms of the categories: the categories and the categories alone determine all the respects in which change is possible (200b32 - 201a9). What better evidence of Aristotle's aim that his definition should be fully comprehensive? But there are more ways than one of dividing

2. On Aristotle's varying uses of 'μεταβολή' and 'κίνησις' see W.D. Ross, *Aristotle's Physics*, pp. 7-8, 45-47.

the class of changes: there can be division, for instance, in terms of cause of change as well as in terms of respect. Some changes are from the natures of substances, some from conscious purpose, some from neither: and just as a proper concern for comprehensiveness leads him to take account of each categorially determined type of change, so it should deter him from concentrating exclusively on changes caused in one of several possible ways. But this, as I shall argue in this chapter, is precisely what does not happen. Aristotle has come to consider change in general because of his interest in nature, since change is that of which nature is the inner principle. But considered as changes, the changes which spring from natures instantiate a concept whose other instances have other sorts of cause. Thus we should expect an adequate analysis of this concept to abstract at some stage from the differences entailed by the differences in sorts of cause, and to display a conceptual nucleus common to change as such. In the present chapter I maintain that Aristotle, on the contrary, takes natural change as the type and model of change as such. As a result, his proposed definition suits only natural changes and changes formally analogous to these, namely those that stem from purpose. But as for changes that are neither natural nor intentional, it is as if they do not exist so far as Aristotle's definition in *Physics* III 1 is concerned, or do not count as changes at all. I shall begin by mounting an argument to show that this conceptual partiality for natural change is responsible for Aristotle's initial unargued assumption that a definition of change will be a definition of κίνησις (rather than μεταβολή).

(4) The distinction between 'μεταβολή' and 'κίνησις' with which I am here concerned rests on a difference between ways of individuating changes. Change necessarily involves the emergence of a new state of affairs B, to the exclusion of some prior state A. (Thus to indicate that there is a change, we should describe A and B by means of incompatible predicates, either contraries or contradictories, as Aristotle says in V 1.) Now (a) we can regard the actual emergence of B as the change. From this point of view, there is no change to B either before or after the moment when B emerges. Thus before the emergence, there was no event describable as a 'change to B'. No doubt there were conditions C causally related to the emergence of B, but these were not the change to B itself, nor any part of that change. Again, someone with knowledge of the causal relationship would have been justified in saying, when C was present, that a change to B would occur, but if the change itself is being identified with the actual emergence, he would not have been justified in saying that the change was occurring. Nor would one be justified in saying that the change was occurring at the moment of the emergence itself, since 'was occurring' implies that what occurred took a length of time to occur, whereas the emergence itself happens in a moment. Thus according to this way of regarding change there is no use for the continuous tenses. On the other hand, (b), we frequently take 'the change to B' as including the conditions that causally led up to the emergence of B. Far from being all of the change, the emergence is the termination of a prior state of affairs which as a whole is regarded as the change to B. Thus in this sense the change to B is, or was, going on before the emergence of B. I shall call these two concepts of change the E(emergence)-concept and the L(leading to)-concept. Now the difference between 'μεταβολή' and 'κίνησις' is this: in speaking of μεταβολή (change from one state of

things to another) we leave it open whether we mean change in the E-sense or the L-sense; in speaking of κίνησις, we mean it in the L-sense.

(5) It is to be remarked that this initial explanation of 'κίνησις' (which in this chapter I usually translate as 'process') leaves us uncommitted on a number of issues. I shall mention two of particular relevance (as will appear) to Aristotle's account. Firstly, the process leading up to the emergence may or may not be usefully described as continuous in the mathematical sense. It is correct to speak of it as going on for a time, but we are under no pressure to decide whether this entails that it (or the time) is infinitely divisible. This is not to say either that we mean to leave open the alternative possibility of its being a succession of mathematically discrete units. The point is rather that we are not committed to applying the dichotomy 'Either (mathematically) continuous or discrete'. Secondly, the process leading up to the emergence may or may not be a condition of the same object in which the emergence itself occurs. Suppose that X is doing something that can be described as 'changing some other object Y'. Then Y is in course of being changed by X, and this licenses an inference to 'Y is in course of changing' (in the L-sense of 'change'). Here 'Y is in course of changing' is true on account of a condition of which X is the subject, even though the emergence in which this L-type change results will be the emergence of a new property in Y. The possibility of this sort of case shows that Y can properly be described as in course of changing (in the L-sense) even at a time when no activity is occurring in Y itself, but only in the external agent X.

(6) It is true that Aristotle generally seems to regard a κίνησις or L-type change as an identifiable process occurring in the same individual that will eventually be subject of the final emergence or E-type change. But as we shall see, it is to his advantage if the III 1 definition of κίνησις can be interpreted so as to cover the sort of case just described. One immediate advantage of this wider interpretation may be mentioned here. On the one hand, the very meaning of 'κίνησις' implies a process that takes time. On the other hand, Aristotle occasionally speaks of κινήσεις from one state A to a contrary B as happening all at once, apparently meaning by this that the subject spends no time passing from one contrary to the other.³ On the assumption that Y can be said to be in course of changing only on account of an activity of change in Y itself, Aristotle has contradicted himself. For while Y is still in state A, the *terminus a quo* of the change, no change-activity in Y itself has yet begun, and once Y is in B, the *terminus ad quem*, Y's change-activity is over; so that if its being in B followed without interval on its being in A, there was no change in Y that took any time at all. Thus it seems that what happens to Y might be correctly described as a change (μεταβολή), for it is an emergence (of B, or being in B), but not as a κίνησις. But there is no contradiction if we allow that Y can be said to be changing even when considered in isolation it is in a static condition (A), provided that there is occurring some process in another object X which will result (by X's agency) in the emergence in Y of the other contrary B. From this point of view, Y is already changing even when it is in its *terminus a quo* condition; thus the change may take some time even though none of the time it takes occurs between Y's being in A and its being in B.

3. E.g. *Physics* VIII 3, 253b21 - 30; I 3, 186a15 - 16; *De Sensu* 6, 447a1 - 3.

(7) Many phenomena can equally truly be described as changes in both the E-sense and the L-sense. That is to say, we can either identify the change with the emergence of a new state, to which the preceding condition is conceptually external though causally related, or we can include the latter under the change itself, which in that case is being considered as a process. It seems that the choice of which principle of individuation to use in a given case is often determined by epistemic considerations. If we perceive the emergence of B but do not know what led up to this causally, then we describe the preceding conditions as 'whatever caused B' and regard them as the conditions in which the coming about of B, or the changing to B consisted, or more briefly, as the leading-up to B; for there is no other specification of these conditions available. Again, if the causal conditions are known but uninteresting by comparison with the emergence of B itself, we shall be less inclined to give them the equal status as objects of attention that would be suggested by a conceptually self-sufficient specification, even when such is available; we shall therefore tend to think of them, again, simply as what leads up to B. For this reason we describe the actions leading to an intended result (even when these can be separately described) as the process of bringing about of that result. However, there are some changes in which the event immediately leading up to the result cannot be described in conceptually independent terms. These are changes of spatial position. Take the case in which the new property B to emerge in Y is the property of being at place P_n . What immediately led up to the emergence of B was Y's going (or being taken) to P_n . And there seems to be no alternative description of this leading-up event which both (a) allows us to say that the event so described was the immediate cause of B's emergence, and (b) is conceptually independent of 'B'. If we describe it as 'going to P_n ',

it is not conceptually independent. If we describe it as 'going to P_{n-1} ', where ' P_{n-1} ' designates some place not far short of P_n , then we have described an event which cannot be regarded as the immediate cause of B's emergence, since more is needed for this than that Y should go only to P_{n-1} . And although going to P_n can take many different forms (walking, swimming, being thrown to P_n , etc.) there does not seem to be anything in which going to P_n consists, the description of which would not entail 'going to P_n '. For instance, the process of coming to the boil consists in (is the same concrete event as) being in contact with the fire (under given conditions, a given length of time etc.). But 'sitting on the fire' does not entail 'coming to the boil', and for this reason, what is described as a process of coming to the boil can also be described as an emergence (of boiling) caused by sitting on the fire. But with 'arriving at a place', there appears to be nothing that corresponds to 'sitting on the fire'.

(8) Since change of place can only be described in L-terms, or as a process, it is not surprising that so many discussions of process (including much of Aristotle's) should revolve round this as the paradigmatic example. But this fact cannot justify Aristotle's assumption that the concept of change in general will be adequately dealt with by means of a definition of process. That assumption would be legitimate only on one of two further assumptions: either (a) all changes are changes of spatial position, and must in the end be described as such, and therefore as processes; or (b) even those changes which can be described as caused emergences are nonetheless best or most properly described as processes. Now Aristotle of all people is in no position to assume (a). It is true that for him locomotion is, for a number of

reasons, the primary type of change (see *Physics* VIII 7, 260a26 ff.), but not because all change is reducible to locomotion. That theory could only be held by a philosopher who takes all large-scale phenomena to consist in the spatial configurations and spatial changes of microscopic constituents. But we have seen how Aristotle's theory of nature as form rules out any such reduction. Therefore, if his approach to the concept of change has a rational basis at all, that basis must lie in (b) above. But why does he assume (b)? This is easily explained on the hypothesis for which I am arguing, *i.e.* that Aristotle's entire conception of change in Book III is governed by the logic of natural change.

(9) Let me begin to support this claim by recalling the distinction expounded in Chapter I (paragraphs (18) - (19)) between appropriate and inappropriate descriptions of the same fact. There we saw Aristotle employing this distinction to solve the paradox of becoming. We saw too that the solution could not satisfy unless it was assumed that the choice of one type of description as "appropriate" was not arbitrary, but rested in the end on an absolute metaphysical difference between substance and accident, or between substance-constitutive characteristics and accidental ones (*v.s.* Chapter I, paragraph (27)). I shall now argue that the concept of a natural substance developed in Chapters I and II cannot be sustained except on the assumptions (i) that natural change is more properly described as L-change, or as process; and (ii) that this type of description is superior precisely because it best reflects the structure that must objectively belong to any change that can reasonably be regarded as manifesting the nature of a substance. In other words, the concept of natural change entails that

some phenomena necessarily and of their own nature have the character of "leading up to" others, while others equally necessarily have the character of being led up to, while not themselves leading further. The idea is of course familiar to us from Aristotle's teleology, but in my view is not a consequence thereof; rather, the dependence runs the other way. It is not entirely certain that Aristotle saw all natural change as teleological. It is not clear, for instance, how the simple bodies, fire etc., could be said to move as they naturally do for the sake of their own good. When he calls these movements 'necessary' (in the sense in which this denies 'for the sake of an end') he may, it is true, be conceding a point for the sake of argument (*v.s.* Chapter II, paragraph (33)); but then again he may not. But it is certain that even these cases involve a relation between phenomena whose status is objectively intermediate ("leading up to"), and phenomena in which the former objectively culminate and which are not themselves intermediate steps to an ulterior culmination. This is the basic structure of natural change as such, whether or not it makes sense to describe the "culminating" state as a good. But in those cases where it does make sense (as in the biological field) teleology is the natural type of explanation to adopt.

(10) Except for the simple bodies, natural substances display many different kinds of change.⁴ The more highly organised the substance the wider the variety of changes. If the changes are described as emergences of perceptibly new states (which often will follow one another in quick succession), then it is impossible to identify any single type

4. *Cf. Physics* VIII 4, 255a10 - 11.

of such change as "natural" to the substance, since none has a better claim to be singled out than another. If on the other hand we say that they are all natural (all, that is, that cannot reasonably be attributed to external constraints), then it becomes impossible to see how they can all be manifestations of a single unitary substantial nature. *Ex hypothesi* the differences cannot be put down to differences in external conditions. If we describe organic changes as series of caused emergences (the cause-events being treated as conceptually isolable from their effects) there is no sense in attributing them to the nature of a substance, nor therefore in regarding a substance as having a nature or being an Aristotelian substance at all. 'Natural substance' becomes a contradiction in terms. If on the other hand the various changes of a particular natural object can as a matter of fact be described so as to bring out in all or most of them a common structure or pattern, then the situation is saved for Aristotle's basic concept. And as a matter of fact this is the case. The simple bodies do each behave in a way that can be perceived to be the same each time. Organisms display a bewildering variety of emergences which are neither bewildering nor so various when they are seen as having in common what (as a matter of fact) they do have in common: a tendency to contribute to the life and on-going of individual and species. Thus the primary and most proper description of these perceptibly quite different emergences must be as "changings towards" some condition T, where 'T' denotes the mature or the healthy state of the organism, or some more narrowly specified condition that implies health or maturity. Unifying descriptions of this latter type have a different epistemological status from the descriptions of the simple bodies as 'falling', 'moving up' etc., which can be applied on the sole basis of immediate perception. In the organic case application of a unifying description requires

experience of trains of apparently quite different events drawn from many different instances. Thus as a rule natural κίνησις is not perceived. Not only are we generally unable, merely by immediate perception, to know whether a change is or is not externally determined: nor are we able to identify what the κίνησις is (what life-supporting condition of what organism it is a change towards). But we can of course perceive the "matter of the process", *i.e.* the particular emergence in which it happens at this moment to consist.

(11) In Chapter I it was necessary to take an oversimplified view of the part played by external conditions in natural change. There it was said that these must be such as to permit the change, but without determining its character. But the distinction between the "matter" of the change (the perceived emergence) and the "form" (corresponding to the overall process-description) makes possible a less schematic and more realistic view of the way in which external conditions contribute to the change. For although they do not determine the form of the change but only make possible a change of that form, they can now be regarded as helping to determine its matter at any given stage, and this without prejudice to the self-sufficiency of the form. It is because of the external conditions that maturing, reproducing, getting healthy etc. consists on one occasion in a change of temperature, on another in a change of position, on another in a different change of position, etc.

(12) By contrast, the natural behaviour of the simple bodies, earth, fire etc., is itself simple and consists always in the same upward or downward movement. From this point of view it is easy, in their case,

to describe the behaviour in a way that brings out its substance-expressive unity. But at the same time, the simple bodies present a difficulty that does not arise for any other kind of natural substance. Natural change expresses the specificity of substance, not only its unity, or not only some unspecific unity (v.s. Chapter I, paragraph (40)). The difference, then, between the uniform movements of fire and earth must be as absolute as the difference between fire and earth as substances. For if they are not different substances, what explains the fact that unimpeded they move always in different directions? Either fire should (sometimes anyway) behave like earth or *vice versa*, or both should exhibit some common behaviour which in fact is exhibited by neither. Or can we say that although they are different substances, the difference is not exhibited in their unimpeded locomotions, so that we need not believe in an absolute difference between upward and downward movement in order to maintain that fire is one type of substance, earth another? But if not in these locomotions, in what changes are these different substantial natures expressed? What other obvious ones are there? And even if there are others, what of the disastrous methodological precedent created by dismissing certain frequent and universally recognised changes as "accidental", and looking for something more recondite to fill the rôle of "substance-expressive" behaviour? The doctrine that only one kind of behaviour is natural to a given type of substance effectively ties Aristotle down to identifying the natural change with whatever behaviour is most familiar and typical to common sense. For once he leaves the beaten track, he requires a principle for selecting the one and only natural change from all the other strange and uncharted manifestations that may or may not be significant; a job which none of his established principles can begin to perform.

(13) It was inevitable then that Aristotle should regard the difference between upward and downward motion as absolute. The difference cannot lie in the shape of the motions, since in both cases this is the same: rectilinear as far as possible. It must then lie in what each is directed towards. They differ because each homes in on something different in kind. Could the "homing points" be determined by physical substances, different in each case? But why should these substances be where this theory demands that they should be, one kind high up to "receive" fire, the other below to constitute a terminal for earth? If the substances simply happen to be where they are, we might as well have said at the outset that fire and earth merely happen to move in their usual directions, so that their directions are not intrinsic to their natures. It is for this reason that Empedocles' principle of "like to like" does not account for the natural motions. For granted that experience supports the view that fire, *e.g.* moves upwards to where more fiery matter already is, nothing in this fact shows it not to be arbitrary that the latter is where it is. Why does it not lie to the north, for instance, so that the motion of the smaller "homing" masses would be sideways; or itself change position, so that the smaller masses go first one way then another to rejoin it? Since in fact the latter go always in the same direction, and it is absurd to suppose that they merely always happen to, then even if their motion is governed by the principle "like to like", it follows that the larger mass of fire does not merely happen to be always where it is. So there must be something about where it is that determines its being there. This "something" cannot, by this very argument, be a physical object or landmark: it must, then, be the very character of the region itself considered simply as a part of space, independently of whatever physical object it holds. But how can different parts of space differ

intrinsically from one another? This makes sense only on the assumption that space is shaped. Probably the simplest hypothesis is the one which Aristotle accepts, namely that space is spherical. We have now the absolute difference for which we have been looking. For the centre of a sphere differs from its periphery regardless of the observer's point of view: what is right from one standpoint is left from another, but what is the centre of S from one standpoint cannot from any other be peripheral to the same sphere S.

(14) Thus it is that Aristotle reinterprets 'upwards' and 'downwards' as 'towards the periphery' and 'towards the centre'; a re-interpretation necessitated by his theory of substantial nature as expressed through change. But before returning to the main discussion, I must try to remove a false impression. The argument just presented seems to attribute to Aristotle the view that space and its parts have a reality prior to and independent of the things that are in space: that there is something, which is the geometrical centre of the physical universe, and something else, its geometrical periphery.⁵ But Aristotle was of course as far from holding any such theory as he was from holding that the characteristic directions of the simple bodies could just as well have been different or variable. To account for these directions by reference to the absolute geometrical difference between the "components" of a sphere (centre and periphery) may be a useful corrective to the idea that there is no intrinsic difference between "up" and "down". But if this commits us to

5. This picture seems to be implied by statements to the effect that Aristotle sees different regions of space as exercising "attraction" on different kinds of body. See e.g. A.E. Taylor, *A Commentary on Plato's Timaeus*, p. 665.

hypostasising the sphere, we are no longer interpreting Aristotle. But there is, I suggest, a way out of the difficulty if we consider the variety of meaning that Aristotle himself attaches to the word 'because'. Fire does not just happen to move in the direction that we call 'up'. It moves upwards because that direction is intrinsically different from any other, thus making manifest the intrinsic difference of fire from the other elements. But the 'because' clause need not refer to an already constituted fact concerning a "periphery" regarded as some kind of distinct reality. It can mean, and I suggest does mean, that fire moves upwards because by so doing it will form the physical periphery or spherical outer shell of the (sublunary) world. It is in the nature of fire to encircle the other three elements. It is in the nature of air and water to range themselves in concentric shells encircled by fire and encircling earth as the centre; and it is in the nature of earth to be encircled by the rest. Thus earth tends towards the centre of the universe for no other reason than that it is the tendency of earth to make the centre of the universe by assuming the central position relative to the other elements. This has the interesting consequence that the natures of each of the four are not conceptually self-sufficient (and in this it may be that they differ radically from more complex substances). For where earth tends would not be the centre unless the other three elements were themselves tending to take up positions encircling earth in their successive layers, and so on for each element in relation to its three peers.

(15) The natural movements of the simple bodies illustrate with particular clarity the relation of change to *terminus* which for Aristotle gives the fundamental structure of all sublunary change. The

terminus is intrinsic to the change, for without the *terminus* there would be no direction of change. Direction is not an extrinsic determination that is somehow added to a *per se* directionless change. Change without direction is sheer abstraction, like *genus* without *differentia*. Aristotle himself also puts the point in terms of the categories.

'There is no process independently of definite respects of change. For in every case what changes changes either in respect of substance, or quantity, or quality, or place. Our doctrine is that there is no common factor running through all these that is neither quantity nor quality nor in one of the other categories. So there is neither process (κίνησις) nor change (μεταβολή) in any respect apart from those mentioned, for there is nothing apart from what has been mentioned. (III 1, 200b33 - 201a3)

Real change is definite change, and definite change is in a definite direction, or a definite pattern, and since the direction is intrinsic to the change, so therefore is the *terminus*. Thus a change must cease once the *terminus* is reached, for to go on beyond the *terminus* would be to continue without direction at all, *i.e.* to continue as a change that was no definite change.⁶ So change, because of its intrinsic *terminus*-directedness, allows a distinction between "complete" and "incomplete" which is meaningless in connection with static conditions, such as being green or being a house. For change can come to an end either because it reaches the *terminus* and has nowhere else to go, or because it is interrupted part-way towards that *terminus*. In the latter case it is incomplete by contrast with the completion it would have achieved had it been allowed to continue for the necessary

6. So when a change ceased in a given subject, this is not because it has been "passed on" to objects in the environment. Cf. D.M. Balme, 'Greek Science and Mechanism I', *Classical Quarterly* XXXIII, 1939, pp. 129 ff., esp. pp. 137-138. The point is all the more startling in that Aristotle believes that the simple bodies accelerate as they near their natural regions, so that at the moment of arrival the up-to-then on-going impulse vanishes when at its maximum.

time. But if a house is demolished or a brown wall painted white, the wall's previous whiteness, the bricks' and planks' previous arrangement, were for as long as they lasted as complete as they would ever have been however much longer they had been permitted to last. And so these static conditions are not self-terminating, since to be so would presuppose being incomplete (because further completable) for as long as they "went on".

(16) It is this self-terminating⁷ character of change that makes it so puzzling to comprehend. Change must be real since it is the manifestation of the primary realities, namely substances. The difference between the occurrence and the non-occurrence of a given change must be as genuine as the difference between the existence and non-existence of some given substance. Yet how can a real thing or a real condition be of a nature to head for its own finish? Static conditions, we have seen, are terminated only by external interference. Organic substances exist for their own continued existence, and since this is not possible indefinitely they make up for it by the power of producing individuals as like as possible to themselves.⁸ Nor is this self-propagatory tendency the unique property of substances. Qualities too such as heat generate new versions of themselves in patients available to receive them.⁹ In fact, Aristotle's theory of the mutual transformation of simple bodies seems to imply the

7. Cf. Chapter I, paragraph (13), and L.A. Kosman, 'Aristotle's Definition of Motion', *Phronesis* XIV, 1969, pp. 40 ff., esp. pp. 57 - 58.

8. See e.g. *De Anima* II 4, 415a25 ff.; *De Gen. An.* I 1, 731b31 - 732a1.

9. Cf. *Physics* VIII 5, 257b9 - 10; *Metaph.* Z 9, 1034a21 ff.

continuing identity of the very same instance of a quality (hot, dry, etc.) as it arranges itself with different quality-partners to constitute a new simple substance, fire (hot-dry) becoming air (hot-wet), etc. But a change of a given type does not of its nature generate another similar change in the same subject, nor yet in another subject. Once the *terminus* has been reached the first time, what need is there to reach it all over again by another such change; and how can it help one individual substance to produce another change like its own change in some other individual? It is true of course that one individual by changing in certain ways will generate another individual of its kind, which in turn will behave in the same way. But it is not that change generates change; rather substance by changing generates substance: change, then, is not directed to its own continuance or the continuance of its like, but to the continuance of substance.¹⁰

(17) The paradox is that whilst change must be real on account of its necessary connection with substance, it is this same connection, spelt out so as to reveal the unity and specificity of substantial nature, that ties change down to an inbuilt *terminus*, and hence to the ambiguous status of a being vowed to its own non-being. On this matter Aristotle's position stands in curiously exact contrast to one strand in the Platonic view of change. In the *Republic* and *Timaeus*, change and becoming are refused any place of their own in the domain of true being and substance. Yet there is a sense in which Plato's becoming, relegated to a limbo peculiar to itself, has just the

10. Cf. *De Part. An.* I 1, 64a18-19.

ontological stability that Aristotle's lacks. Becoming, on Plato's Heracliteanised view, is never superseded except by further becoming. Becoming in its own way is as eternal as the world of Forms. Here I am speaking of becoming in general, and it might be said that for Plato every instance of becoming is necessarily transient. But the theory of the *Timaeus* can be read in terms of a single unbroken and intrinsically undifferentiated process that successively takes on different patterns. The source of becoming is the "receptacle", which is a metaphysical factor in all created things. Since created things are ontologically derivative from it no less than from the Forms, any distinctions we make between numerically and specifically different changes on grounds of their occurring in numerically and specifically different created objects are likewise purely derivative. Behind everything is the one becoming, whose total lack of structure and direction makes it the ideal medium for reflecting the Forms. Here we are not many steps away from the line of thought that culminated in the principle of conservation of energy. Plato himself would have started down this line if besides postulating geometrical structures for his elements to enable their orderly transformations, he had also postulated rules by which the single underlying becoming converts itself from one to another form of empirical energy or motion.

(18) We must now turn in detail to Aristotle's definition of κίνησις.¹¹ He introduces it as follows:

'We distinguish between what is only actual, and what is potential and actual. This may be substance, quantity, quality, or in one of the other categories of being. Under the category of

11. For an interesting close study see L.A. Kosman, *op. cit.*

"relative to something" fall excess and defect, agent and patient, and in general mover and mobile. For the mover is mover of the mobile, and the mobile is able to be moved by the mover. There is no κίνησις independently of definite respects. For in every case what changes (τὸ μεταβάλλον) changes either in respect of substance, or quantity, or quality, or place. Our doctrine is that there is no common factor running through all these that is neither quantity nor quality nor in one of the other categories. So there is neither κίνησις nor μεταβολή in any respect besides these, since there is nothing besides these. Each of these applies in two ways to a subject, in all cases: for instance, as regards substance, there is the shape of it and the privation; for quality there is [*sc. e.g.*] white and black, with quantity, the complete and the incomplete. Similarly in locomotion too there is up and down, or the light and the heavy. Thus there are as many kinds of κίνησις and μεταβολή as there are of being.' (III 1, 200b26 - 201a9)

(The last statement will be modified later by the arguments in V 1 - 2, where Aristotle shows that the only categories in respect of which there can be change are the four he explicitly mentions here.)

(19) This passage leads up to the definition at 201a9 - 15. There Aristotle will state that change is a certain type of actuality. Uncompromisingly, this means that change is real, as real as anything else actual is real. But the point must be carefully prepared since it contradicts so much of the philosophical tradition. And this means too that the definition itself will fail unless it manages to give due weight to just those considerations (however vaguely in the past expressed) that led so many of Aristotle's predecessors to deny the reality of change. In part their problem lay in not seeing how the concept of change could involve "not-being" without thereby consigning itself to its own non-being and absurdity. Already in Book I 7 - 8 Aristotle has shown one way out, in terms of substance and accident and the subject that remains. But as he said at the time (I 8, 191b27 -

29), the concept of potentiality also carries a remedy, and this is what he invokes here. Something comes to be what previously it was not. But to say simply that X was not-P is misleading. This bare statement contrasts X with things (including itself later) which are P, in a way that takes no account of another and equally essential contrast, namely between X's being not-P and the not-P-ness of things that never are or can be P. Even when X lacks the actuality, it has the potential; and this is something. Change then must be conceptually located in the domain of what is sometimes actually and sometimes potentially P, and this is Aristotle's point in the first sentence of the last quotation. But what sort of "something" is a potential? If it is anything definite then surely it is a way of being, not of not-being; but unless it retains something in common with not-being (so that 'potentially P' carries some of the same message as 'not-P') it will be no use to explain change. Is potentiality then simply indefinite, a kind of being that is not anything in particular? Aristotle has already made clear his repudiation of any such concept, when in I 4 he argued against Anaxagoras' "Infinite".¹² But the positive answer of course lies in the categories. What is actual is actually P, where 'P' is a predicate in one or another category; and the potential is only ever potentially what it would be if actual. Thus potentiality in any given case is as definitely specifiable as actuality, being specifiable in exactly the same terms. There can be no indescribable potentiality for the reason that all actualities are specifiable by categorially pigeon-holed predicates. So an indescribable potential would be one for which there was no corresponding actuality; which is impossible.

12. See especially 187b7 ff.; also *Metaph.* A 8, 989b6 ff.

(20) Thus far Aristotle is making the point which most obviously emerges from the passage last quoted: that change is from potential to actual in some definite respect. But now he has a problem, and it is this problem that explains his apparently disconnected remarks in the third and fourth sentences.¹³ The passage as a whole would read more smoothly if these were omitted, but (so far as I know) there is no independent evidence to suggest their having crept in from elsewhere. And if they were omitted, Aristotle would not be able to pass as he immediately does in the next section to his definition of change as itself a sort of actuality. To show that change is respectable and real it is not enough to show that it is the passage to a real property, an actuality, from a no less definite potentiality. For any ground that is hereby gained would immediately be lost if a critic were still able to argue that nonetheless Aristotle has failed to show that change itself is something actual. But Aristotle has now tied "actual" to the categories (so as thereby to anchor "potential") in such a way that nothing that is not in some category or other can be said to be actually anything. So he has to be able to show that change is not only in respect of categorially specifiable properties, but also itself finds a niche in some category or other. And this must mean: in one or another of the already recognised categories, since to create a special one *ad hoc* would only concede the critic's point. Now Aristotle is bound, I think, to choose for change a category in respect of which there is no change. For if a change-condition were classed as (*e.g.*) a quality (a category that already has a fairly mixed bag of members), then since change is possible in respect of

13. Cf. Ross, *op. cit.*, p. 535: 'The connexion of this section with what precedes is not very close'.

qualities, there could be change in respect of changes. But Aristotle cannot admit change of change to be a coherent concept, notably because he holds that if something is said to change to changing in a given way, it must also be said to change to the change to this change, and so on (*cf.* V 2, 225b33 ff.). Now the category of Relation is one in respect of which it makes no sense to speak of change, for all so-called relational changes are already taken care of by changes in other categories. If X dyes his hair darker than Y's no extra "relational" change is needed to account for the fact that Y's has "become" lighter than X's. So the category of Relation (which like that of Quality already includes a lot of different kinds of properties) is chosen to house change. But this will not do unless change is relational! Now when agent acts upon patient, this is a kind of relation. Also it involves change, since the agent causes some new condition in the patient. Logic alone, it is true, cannot take us from this to the conclusion that every change is by agent upon patient and therefore necessarily relational. But Aristotle does not need to believe this inference valid in order to embrace the conclusion. The pressure is metaphysical. Even natural change, where the object changes "of itself" must, we now see, somehow involve agent and patient: in fact natural change above all, since this is the primary type without which there could be no other. How agency and patiency finds a foothold in natural change is a problem which, as we shall see, Aristotle is very far from able to brush aside, but he has no choice but to take it on, since the only alternatives would be to allow that change is not strictly real or else that his categories fail to comprehend all that is real.

(21) Aristotle continues:

'Given the distinction (which applies in each category) between that which is actually (ἐντελεχέα) [sc. so and so] and that which is potentially (δυνάμει) [sc. so and so], κίνησις is the actuality (ἐντελεχέα) of that which is potentially [so and so], insofar as it is potentially [so and so]. Thus the actuality of the alterable insofar as it is alterable is alteration; of what can grow and contrariwise shrink (there is no common word for both) it is growing and shrinking; of what can come into being and pass away it is coming into being and passing away; of what is spatially mobile it is locomotion. That this is what κίνησις is may be shown as follows: when materials that can be built up into a house possess actuality insofar as they are as we have just specified [sc. capable of being built into a house], then they are being built up, and this is the process of building. It is the same too with learning, healing, rolling, jumping, maturing, aging.'

(III 1, 201a9-19)

Here Aristotle gives his formal definition of κίνησις. He first puts it in general terms, then in terms of specific types of processes, and then appends examples. The definition is obscure in both its formulations, and the examples do nothing to make it clearer.

(22) The main difficulty concerns the meanings of 'potentially [so and so]' and 'alterable' etc. However, let us begin with the 'actuality' ('ἐντελέχεια') that κίνησις is here stated to be. Some¹⁴ render this as 'actualisation' and 'realisation': misleading terms, in that they can mean the process of becoming or making real or actual. Aristotle cannot be read as defining process by 'actualisation' in any such sense, since that would be blatantly circular.¹⁵ Circularity

14. E.g. E. Zeller (or his translators), *Aristotle and the Earlier Peripatetics*, vol. I, p. 381, note 1; P. Wicksteed and F.M. Cornford, *Aristotle, The Physics* (Loeb ed.) vol. I, p. 195; Ross, *op. cit.*, pp. 45, 359 ff.

15. Cf. Kosman, *op. cit.* p. 41.

apart, to offer such a definition would be to give up the fight to show that process and change are themselves real and actual. For if one says only that a change tends towards some eventually actual end-state, one is left with no basis for maintaining that the tending itself is real while it continues and of an ontological status commensurate with that of the actuality brought about. But process must itself be an actuality even though it is the making or becoming actual of some state not a process; thus Aristotle aptly calls it an 'έντελέχεια', a word that says that becoming, when it takes place, does so not because it itself becomes, but because it successfully manages to be.¹⁶ However, those who translate 'έντελέχεια' here as 'actualisation', when 'actuality' would be more appropriate, may be impelled by the sense that process and change are activities, as opposed to the apparently static and inert actual conditions in which processes start and terminate. That is, 'actualisation' and 'realisation' capture the dynamism which is essential to change, and which may seem to be lacking to actuality as such. And here we may wonder whether this too does not show Aristotle's definition to be circular from the start, since we may think that because the most obviously active activities are changes and processes, this is the case with all activity; so that 'activity' already implies process and change, which

16. 'Έντελέχεια' is preferable to the equivalent 'ένέργεια' (used of process at III 2, 201b32 - 202a2) because, Aristotle tells us, 'ένέργεια' in its original and most usual sense (on which he refines in *Metaph.* Θ) means the actual occurrence of process (see *Metaph.* Θ 1, 1046a1 - 2; 3, 1047a30 - 1047b2). C-H. Chen, in 'The Relation between the terms ένέργεια and έντελέχεια in the Philosophy of Aristotle', *Classical Quarterly* N.S. VIII, 1958, takes *Physics* III 1, 202a10 as evidence that 'έντελέχεια' has a secondary "kinetic" meaning. However, he supports this from no other contexts, and the present one proves, if anything, the opposite of Chen's contention, for if the word did have a "kinetic" meaning this would *ipso facto* render it unsuitable to stand on the right-hand side of a definition of 'process'.

therefore turns up on the right-hand side of its own definition. But this fear is quickly settled when we consider that being active may take the form of preserving some state of affairs rather than changing it, so that the man who keeps his head is no less actively exercising a potentiality than those "all about him", who exercise their potentialities for panic and hysteria. A physical object which, on the Newtonian view, continues indefinitely to move with constant speed and direction thereby evinces what is just as truly described as 'behaviour' as its change of velocity in reaction to external force; yet the former behaviour by comparison with the latter is a mode of staying the same. I have not here drawn upon Aristotle's own favourite examples of activities that are not changes, such as exercising a skill (as opposed to learning it), and perceiving and thinking,¹⁷ since their non-kinetic status may require to be justified, in which case they would be poor illustrations. But it is enough that there are some illustrations for us to grant that in calling change and process 'activities' or 'active exercises of potentiality', Aristotle is not simply allotting them to a class of which it is analytically true that all its members are changes.

(23) But a more likely prey for the circularity-spotters¹⁸ is provided by that part of the definition where Aristotle speaks in general and then in more specific terms of the potentiality of which process is said to be the actual exercise. Here the issue cannot be

17. Cf. *Metaph.* θ 6, 1048b23-24; *De Anima* II 5, 417b3-9. V.i. Chapter IV, paragraphs (27) ff.

18. E.g. P. Duhem, who makes the charge without particularising, *Le Système du Monde*, vol. I, p. 160.

settled by examples, only by analysis of the concepts involved.

Consider in particular the more specific formulations. Alteration, he says, is the actuality of the alterable insofar as it is alterable; growth/shrinkage is the actuality of what can grow and shrink insofar as it can do so, etc. But 'alterable', it is pointed out, means capable of, or having the potentiality of, altering. So Aristotle is defining each type of process as the actuality or actual exercise of the subject's potential for - that type of process.¹⁹

Now in a way this is exactly what he is doing, because the potentiality of which change is defined as being the actual exercise is indeed the potentiality of that change itself. But that potentiality can and must be spelt out in terms that make no reference to change, and for this reason the definition is not circular. For the part of the *definiens* in which the *definiendum* occurs can be analysed so that the *definiendum* no longer occurs in it explicitly or implicitly. Leaving aside for the moment consideration of external conditions, we ask: what has to be true of a given subject, taken on its own, if it is to be properly described as having the potentiality for a certain change? If the change is a process towards being in some new condition C, then the subject must (i) lack that condition but (ii) be suitable for being in it. Thus a healthy man lacks the potential for convalescing since in his case (i) is not fulfilled; and water cannot be made into a pair of gloves through non-fulfilment of (ii). But these conditions

19. This is Ross's interpretation, *op. cit.*, p. 536 (although Ross vacillates; see Kosman, *op. cit.*, pp. 43-46). Ross is followed by J.L. Ackrill, 'Aristotle's Distinction between ΕΝΕΠΤΕΙΑ and ΚΙΝΗΣΙΣ', *New Essays on Plato and Aristotle*, ed. Bambrough, pp. 121 ff., esp. pp. 138-140. For criticism based on what I take to be the correct interpretation, see especially T. Penner, 'Verbs and the Identity of Actions', *Ryle*, edd. Wood and Pitcher, pp. 393 ff., esp. pp. 427-431; also Kosman, *op. cit.*, pp. 44-45.

of the subject (i) and (ii) not only constitute that subject's potentiality to change to the state in question: they are also what is meant by the statement that the subject has the potential to be in that state.²⁰

(24) The point will be clearer if we consider the passage immediately following the one just quoted, where Aristotle speaks of the actuality and potentiality of states brought about through change, states such as being hot and cold. He says:

'... in some cases the same things are both potentially and actually [so and so], but not at the same time, or not in the same respect: for instance, what is hot is potentially cold.' (201a19 - 21)

These words show that this is one of the many contexts in which 'actually F' and 'potentially F' are being used as mutually exclusive, or in which 'potentially F' means 'only potentially F', *i.e.* 'suitable to be F, but not actually F'.²¹ In this sense, the potentiality to be in condition C is identical with the potentiality to change to being in C. Thus in saying that alteration is the actuality of what is alterable insofar as it is alterable, Aristotle is saying that alteration is the actuality of a subject truly described as having the potential to be in whatever final condition the alteration in question is an alteration to. And although this condition will come

20. That the potentiality is (primarily) the potentiality to be in the end-state is supported by *Physics* VIII 5, 257b6 - 10, which makes sense only if 'τὸ δὲ δυνάμει' in 6 - 7 means 'potentially hot' (*v.i.* Chapter V, paragraph (38), note 27). This is the interpretation of Themistius; see esp. Schenkl, p. 70, 33 - p. 71, 5. It is also presupposed by Simplicius' remarks at Diels p. 414, 1 - 6. Recently Kosman, *op. cit.*, pp. 44 - 45 and Penner, *op. cit.*, pp. 429 - 431, have come to the same conclusion.

21. Cf. Bonitz, *Index Aristotelicus*, s.v. 'δύναμις' (2), p. 207b33 ff.

about through alteration, its nature can be specified without reference to alteration or the way it came about, *e.g.* as white, hot, etc. And in the more general formula of definition ('Process is the actuality of what is potentially so and so insofar as it is potentially so and so') we can if we like fill in the 'so and so' with a phrase like 'undergoing process' and thus obtain a circular definition; but this does not matter, since 'potentially undergoing process' is cashable in terms that make no reference to process, *i.e.* as 'suitable to be in some new (static) condition C but not actually in C'.

(25) In change three different actualities play a part; the actual change itself, the actual result or product of change, and the actual subject in which the change occurs. An adequate definition of the first of these three must make it possible to draw a formal distinction between it and each of the others. In distinguishing change from subject, Aristotle relies on the point central to his discussion of change in *Physics* I 7-8, that sameness in number does not entail sameness in formula. Just as the man was uncultured, so the bronze is potentially a statue. But to be bronze is not the same thing as to be potentially a statue. If it were, we should have equal right to say that to be bronze is the same as to be potentially anything that the bronze can be, a helmet, a dish, etc. Then all these potentialities would be the same as each other (because each is the same as being bronze), and this would imply identity-in-formula of the corresponding actualities, the statue, the helmet, etc. But once the difference between being bronze and being potentially something that bronze can become is grasped, there is no difficulty in formally distinguishing the actuality in which a change consists from the actuality of the subject. The change holds of the subject only insofar as

the latter has the potentiality to be so and so. It does not therefore hold of the subject insofar as the subject is the kind of thing it is, bronze. Nor is the actuality of the change the same thing as the actuality of being bronze. If it were, then there would be no difference between what it is to be bronze and what it is to change in that given way. There would be no subject of change determined as to its nature by a substance-constitutive characteristic; for the "substance"-constitutive characteristic would be - to be changing. Substance would be change.

(26) To display the difference between the actuality in which change consists, and the actuality that comes about through change, it is enough to attend to the sense of 'potentially F' already explained. The changing that turns the bricks into a house holds of the bricks insofar as they are not a house but suitable to be so formed. The actuality of the house-form itself also holds of the bricks at a later stage, but not insofar as they are potentially a house. Or, if we wish to say that they are, a different sense of 'potentially' must be called in, one that refers only to the bricks' suitability and the positive characteristics, hardness, weather-resistance, etc., that render them suitable. For the bricks built up are not now potentially a house in the sense in which this implies that they are not actually so formed. Thus the change-actuality differs from the product-actuality in that the former holds of its subject in virtue of an irreducibly negative condition. This phrase 'in virtue of' cannot be understood in logical terms. Aristotle's definition of change does not state the obvious falsehood that the subject's not being F is a sufficient condition of its changing to being F. That would imply no difference between the actuality and the mere potentiality of change. But it states more than that not being F is a necessary condition of

its changing to being F. It is not the case that every actuality that obtains only if the subject is in some negative condition is a change towards the corresponding positive one. The actuality of being formed as a statue is true of the bronze only if certain other things are not true of it, such as being formed as a helmet. But being a statue, which is an actuality, is not the actuality of becoming a helmet. If it were, then by the same argument, being a statue would be the same as becoming a set of coins, a set of nails, etc., and all the things that the bronze logically cannot be if it is a statue. The relation between the negative condition of the subject of change, and the actuality of change itself, is stronger than necessary but weaker than sufficient. The change is the active expression of the negative condition and is grounded in it. Changing to F is what something does on account of being not-F, and the change is the manifestation of the absence of F. But when 'being a helmet' holds good of the bronze, this is not on account of the bronze's not being something else, nor does being a helmet express this negative fact. Being at Athens entails, but does not express not being at Sparta, whereas going to Sparta both entails the latter and expresses it.

(27) In general we may say that the following holds of actualities that are not processes: just as we give no information about what or where or what-like a thing is by stating what, where, etc., it is not, so we give none about the basis or ground of its being as it is by saying what it is not. But with process-actualities the opposite holds good. We give the ground and basis of what actually is true of the subject (namely the fact that it is changing) by saying what the subject is not. We can deepen the contrast by noting that the terminal

condition whose absence is the ground of the change is such that its presence will necessarily exclude the change itself. Being a statue is incompatible with becoming just such a statue. Therefore becoming a statue is an actuality grounded not only in its subject's potentiality to be a statue (which it is not), but in its potentiality to be in a state in which the former actuality no longer exists. In short, change is the active expression of a subject's potential to be no longer changing. Whereas it would be absurd to say of a non-process actuality A that it expressed its subject's potential to be, eventually, without A. In this way, Aristotle's definition of change and process succeeds (a) in avoiding circularity, (b) in defining change as something real and actual, and (c) in preserving a fundamental type-distinction between process and non-process. This last requirement is as essential as the others, if only because the definition must give some explanation of the problematicity of change. If becoming were simply a sub-class of being, differing from other sub-classes no more radically than they from one another, how could anyone have been so misled as to think that becoming made best sense when consigned, by one argument or another, to the realm of non-being? We have now seen how the definition meets requirement (c) by exhibiting the subject of change as essentially (*qua* subject of change) in a state of privation.

(28) Aristotle sums this up by typifying process and change as 'incomplete actuality'. He does not mean that change is not a genuine actuality. Its incompleteness is derivative: process is incomplete 'because the subject of whose potentiality it is the actual exercise is incomplete' (III 1 201b31 - 33). We might wish to carp at this

formulation on the ground that the subject's negative condition may not necessarily render it 'incomplete'. That is to say, 'incomplete' here can hardly be understood except evaluatively, but the property which a subject acquires through a given change need not be one that enhances or fulfils the subject: it might be one that is neutral in terms of value, or one that although describable in positive terms (so that as such it is not a privation) constitutes a damaging condition for the subject, as *e.g.* being on dry land for a fish. In other words, the formulation just given can only be guaranteed to cover natural and purposed changes to states valuable or "proper" or life-enhancing for the subject. Aristotle could have avoided this objection by stating the special structure of process-actuality in terms of the subject's negative condition, without committing himself to any evaluation of the corresponding positive one. But there is little point in attempting to correct him on this detail, since as we shall see, the entire analysis is moulded to fit not change as such but natural and purposed change. His description of the subject as 'incomplete' reflects an orientation so pervasive that any attempt to accommodate the account to all changes, natural, unnatural and any others that there might be, would result in its collapse.

(29) Before I proceed to argue for this claim, as well as to point out certain advantages of the account just developed, a few remarks are in order concerning the relationship between this analysis of change and the positions variously reached by Aristotle's predecessors, and secondly between this analysis and Aristotle's own main results in the first two books of the *Physics*. So far as the earlier philosophers are concerned, Aristotle is anxious to show that the very feature of

his own theory that guarantees an ultimate distinction between process-actualities and others, also explains the bafflement that drove his forebears sometimes to deny change altogether and sometimes to define it in strange terms that succeeded in expressing little beyond their own sense of its incomprehensibility. His own words make the point.

'A proof of the adequacy of this account may be found in what others say about process, as well as in the fact that it is not easy to define it in any other way. For the only heading under which process and change find a place is the one suggested here. This is clear if we consider how some thinkers²² define it: as otherness, and inequality, and not being. Process is not a necessary property of things describable in any of these terms, *i.e.* as other or unequal or not being. Nor is change to or from these properties rather than to and from their opposites. But the reason why they located process among these is that it does seem to be something indefinite, and the principles in the second column²³ are indefinite on account of being privative. For none of them is a this or a such or in any of the other categories. The reason why process is regarded as indefinite is that it cannot be straightforwardly allotted to the domain of potentialities, nor to that of actuality. For something that is potentially of a certain quantity is not necessarily in process, nor is something that is actually of that quantity. Process emerges as a kind of actuality but incomplete. This is because the subject of whose potentiality it is the actual exercise is incomplete. And because of this it is difficult to seize what it is. For it has to be either privation or potentiality or actuality in the strict sense; but it cannot be included among any of these. So our approach is the only remaining one, which is to say that it is a sort of actuality, but an actuality such as we have explained: difficult to grasp but capable of being.' (III 2, 201b16 - 202a2)

22. See Ross, *op. cit.*, pp. 538 - 539.

23. Cf. *Metaph.* A 5, 986a23 ff.

(30) Turning now to the relation between the account of change in III 1 - 2 and the doctrines of the earlier books, I shall take space here only to touch on one large issue. This concerns the coherence of the concept of subject of change developed in III, with the earlier schema in which change was related to the idea of substantial nature. Much has already been said about the way in which Aristotle's concept of substance as unitary and specific determines his notion of change, and of natural change in particular. But the examination of III 1 - 2 enables us to detect an equally close dependence in the reverse direction, this time of the idea of substance itself upon the account of change formulated in III. Let me begin to glance at this major topic by raising the question whether there is not a contradiction between the Book II doctrine of change as expressing substantial nature, and the Book III doctrine of change or process as the activity of the subject insofar as it lacks the property gained as a result of the change. For if natural change expresses substantial nature, which if knowable at all is susceptible of positive specification and definition, how can it also express some negative property possessed by the subject for as long as the latter is changing but no longer? The two positions are easy to reconcile in fact, but the basis of reconciliation deserves attention. Aristotle means that whereas it belongs to the substantial nature to dictate the kind of end-state to be reached through change (if possible and necessary), it is the present lack of this state that accounts for the change's actual occurrence. The nature determines what change will be if any will be, but the privation determines that it will be, circumstances permitting. The difference between the rôles of nature and privation is clear if we recall that nature is a principle equally of change and stasis. Which alternative is realised on a given occasion depends

then not upon the nature, but upon the presence or absence of the natural end-state which the natural stasis is at and the natural change towards.

(31) But the main point of interest to emerge from this answer is this: were it not for the assumption that the change terminates, Aristotle would find it difficult if not impossible to disentangle the positive and essential substantial nature expressed through change from the accidental negative condition which, by the account of III 1 - 2, is also thereby expressed. Given a *terminus* or intrinsically determined stasis, there is a "moment" of change in which the negative condition can no longer be actively exercised, for the simple reason that the stasis has superseded it with its own positive, so that it is no longer there to be expressed. This being so, we can conceptually sift out the substantial nature from the negative property by insisting that the former is still expressed even when the latter cannot be, *i.e.* through the terminal, static, condition. And we can add that unless the same substantial nature is supposed operative then as during the change, there is no basis for regarding the now changing, now static, subject as one and the same individual. But now let us consider the conceptual impact of denying an inbuilt termination to change. Suppose for instance that the direction of change were dictated by some "ideal" *terminus* which the subject by nature is unqualified to be able to reach. Plato's concept of imitation might be construed in this way, the particulars being regarded as aspirations rather than static "copies". In that case, the subject would necessarily always be subject of change and as such never free from the privation. Thus it is not surprising that the Platonists should have

committed what Aristotle evidently takes to be a serious mistake in equating the Great and Small (which in their system he sees as filling the rôle of matter or subject of change in his) with not-being or the privation opposed to the form towards which becoming tends. He takes them to task for thus reducing the number of principles involved in change from the Aristotelian triad (subject - form - privation) to an inadequate pair (*Physics* I 9, 192a3 - 25). In this, Aristotle makes no allowance for the fact that within the Platonic framework the reduction was reasonable not to say inevitable, if only because there is never a time when the extensions of the subject-concept and the privation-concept could ever fail to coincide. Aristotle on the other hand assumes that the subject of change, *e.g.* a man, will emerge on the other side of the change as no longer changing, *i.e.* as a now cultured man. Thus he can dissolve the paradox of becoming by insisting that although the troublesome 'What is not comes to be' is not false, it fails to reveal the true structure of change by describing the subject with a term true of it only *per accidens*, the appropriate description being the positive 'man'. The best proof that 'not cultured' holds only *per accidens* is that it is what is left behind after the change. In this way the individual that was subject of change emerges as *per se* positively describable; its essence then can be given by saying what it is, not what it is not.

(32) Here we have the basis for the doctrine of the categories, whereby negative properties are negations of positives in some category or other. There would be no categories other than Substance unless there were the category of Substance: this then must comprise positive terms (substance-constitutive characteristics), since other-

wise the whole doctrine collapses. This means that the concept of substance as king-pin of the categorial division of being is reconcilable with the concept of substance as subject of change on one assumption only: that change (depending as it necessarily does on its subject's privation) cannot continue indefinitely towards an unattainable end. Change must be structured so as finally to release its subject de-negativised, thus showing that the negative property was never intrinsic to the latter. Change and process then must be as the definition of III 1 prescribes: an actuality incomplete in itself and self-terminating. These considerations give special significance to the fact that the term for 'potential' is also the term for 'possible'. Verbally it is probably tautologous to say that what is potentially so is possibly or not impossibly so.²⁴ But a substantial point emerges when we consider that within the context of Aristotle's definition of process, 'potentially F' has the function of stating the direction of change. In other words, 'potentially F' harbours one purely intentional element, which it might be more apt to call 'gerundive', stating what is to be and would be if the change were to reach completion. And that the state F that gives specific content to this gerundive is one that the subject can attain, is a synthetic proposition, although for Aristotle nonetheless necessary *a priori*. It is necessary for him *a priori* because, as I have tried briefly to argue, the categorial conception of substance depends upon the actual terminability of change. In the *Physics*, as for instance in the *Ethics*, Aristotle usually treats his doctrine of categories as a starting-point already settled prior to the task of conceptualising the specific subject-matter in hand. This of course is why he can then use it as a

24. Cf. *Physics* VI 10, 241b3 - 11, and paragraph (52) below.

tool. But the issue just raised shows that in one case at least, the dependence runs the opposite way too. Aristotle's definition of change, a physical concept, sustains his theory of the categories.

(33) We must now return to the definition itself and its consequences. So far I have attended only to its formal structure as stated by Aristotle in III 1, 201a9 ff. But there are two ways of interpreting this. On the one hand, it can be understood as analysing the common meaning of process-words. These form a fairly obvious class in Greek, as in English, the verbal nouns being usually of the '-σες' ending. On this interpretation, 'κίνησες' on the left-hand side of the definition may be regarded as a variable ranging over the class of "entities" individually named by specific process-nouns. Taken in this sense the definition presupposes that language already marks off the class of actualities that fall under it. The job then of the definition is to tell us what these linguistically specified actualities have that is common and distinctive. On the other hand, the definition can also be taken as laying down the conditions under which we are entitled to regard an actuality as a process whether or not the standard linguistic expression for that actuality is a typical process-word. On this interpretation, if it is actually true of a man that he is standing still, but this actuality holds only insofar as something else is not yet actually true of him, as for instance when he stands on the doorstep waiting to be let in, so that his being there is the expression of his not yet being where he is going, then under these conditions, the definition tells us, the standing is a process, and the standing man may be regarded as 'ἐν κινήσει'. And indeed ordinary language would not reject the description 'He is on his way inside'. Similarly

if an animal lies in wait for its prey; in lying in wait, it is "on the road" to some end, and the lying in wait is grounded in its not having got there, since this is the means.

(34) It is hard to think of examples illustrating this last point in which the behaviour is not purposive or lends itself to description in purpose-like terms. However, the fact that Aristotle's definition of process can be interpreted so as to fit even a narrow class of examples such as the above shows that in one area at least, the difference between process-actuality and non-process-actuality does not depend upon any immediately perceivable on-goingness or moment to moment emergence of new properties. This suggests that although in III 1, 200b16-20 Aristotle names 'the infinite' as one of the concepts to be examined in his philosophy of nature, on the ground that process is continuous, and infinity rears its head in connection with continuity, his actual analysis of process does not represent it as mathematically continuous or infinitely divisible of necessity. This is an advantage, for had he restricted 'process' to situations which it is not unreasonable to describe in terms of mathematical continuity, he would have consigned to conceptual limbo a vast range of occurrences that we should naturally class as processes and becomings; including many examples of his own. How could we begin to apply the model of the continuous series to getting healthy, or to house-building? It is not clear how any type of change apart from locomotion (and increase and decrease so far as they imply locomotion of an object's boundaries) could be handled in this way. And for Aristotle, not only is change in general not scientifically reducible to locomotion (*v.s.* paragraph (8)), but even if it were, conceptual reduction would still

be out of the question. A given change is of the kind that it is on account of the type of end-state in which it terminates. Unless the latter not only empirically depends on but essentially consists in some spatial arrangement, macro- or microscopic, the change itself cannot be characterised as locomotion. Being healthy may as a matter of fact consist in a certain disposition of "primary qualities", but to call this health is simply to evoke a *per accidens* identity. This is not what the convalescent is regaining insofar as he is so described. One might as well say that health is the same thing as warmth, on the ground that getting better in his case involves a rise in temperature.

(35) In paragraph (5) above we noted that an object Y may coherently be said to be in process, or in course of changing, on account of some condition in another object X which leads up to the emergence of a new property of Y. Thus someone is already 'getting his hair cut' even when the barber is only fetching the scissors. In this way it is possible to preserve the ordinary implication of 'process' as taking time while predicating the term of changes where the subject passes all at once from one state to another. Now the III 1 definition still permits the application of 'process' to such events, provided that the "leading-up" condition in the agent can be seen as grounded on and explainable by the patient's current non-possession of the property in which the change terminates. This point is of some importance for Aristotle's system, since it is only by some such analysis that he would be entitled to class as 'processes' one vitally important group of changes, those switches of quality-pairs that constitute the mutual transformations of the simple bodies. These must be instantaneous in the subject because they are qualitative, for Aristotle does not hold

that between every pair of qualities terminating a change there is another quality "through" which the subject must "pass", thereby taking time to get from one *terminus* to the other.²⁵ And while this is true of qualitative change in general, there is an extra reason why the transformation of the elements cannot be a process whose subject takes time to move from one to another *terminus*. The *termini* of elemental transformations are the quality-pairs that constitute the physically simple substances, and "between" two such pairs there is no further substance for the subject to be, which means that if for any time "it" were between *termini*, there would exist something of which nothing whatever was true, for if the subject is not substantialised (by bearing a quality-pair), it cannot be qualified, quantified, or anything else either.

(36) Thus far, then, the definition can be shown to be usefully flexible: but is it a definition of change in general, or even, in general, of "led-up-to change" (*v.s.* paragraph (4))? By now, I suppose, the answer is fairly obvious. Where it makes sense to say that the change's occurrence is grounded in the fact that the subject lacks a given property which it is capable of possessing, there the definition applies: otherwise not. Natural change and purposed change then immediately fall under the definition: if it is something's nature or purpose to be P, its being not-P grounds and explains the actual change to P. Now there are some unnatural but not artificial changes which can nonetheless be brought within the fold: these are ones that are "nature-directed" but by the nature of some

25. *V.i.* paragraphs (44) ff. On the finite number of sensible qualities in a given range, see *De Sensu* 6, 445b20 - 446a20.

external agent. Thus if bees bring pollen to the hive, the pollen's being transferred may be seen as grounded on its not being (naturally) where it will eventually be, the latter location being gerundively marked out for it by the needs of the bees pursuing their own natural existence. But what about changes dictated by no nature or purpose, whether external or internal to the subject? What for instance of the twig that gets entangled in some animal's pelt and so is carried along? The animal goes from P_1 to P_2 ; so therefore does the twig. This description of the event logically entails that the twig is not at P_2 , since it is attached to a creature that is (by its own nature, let us suppose) going there. But we have already seen (paragraph (26)) that the fact that the presence of a given actuality in a subject logically implies some negative condition of that subject does not by itself permit us to view the actuality as grounded upon that negative condition or in any sense expressing it. The fact that the stones are not formed into a pavement is not the ground of their being what they actually are, namely formed into a wall. Again, it follows from our description above that the twig is not at P_1 either, but what is happening to it is not grounded on this, for then by Aristotle's definition it would be in motion to P_1 . But why should we not say that the twig's motion is after all grounded upon its not being at P_2 , even though the motion is caused by an animal which in no sense "means" it? The reason is that the motion of the twig is without intrinsic direction. We only say that it is to P_2 because that is where the carrier is going, or because at that point the twig gets detached and left. But the twig would have moved as it does move in just the same way even if the animal had gone further or not so far. In itself the twig is no more going to P_2 than to any of the points in between. Yet within Aristotle's scheme of concepts it cannot be said to be going

to any or all of the points along the line of its actual course, for this would mean that it had not one motion but many, and infinitely many. The unity of the twig's passage cannot, within the present system, be described by the simple expedient of showing that a single mathematical formula will generate all the possible and actual positions of the twig along a line thus defined by the formula. For this implies a profound shift from Aristotle's own position, which is that the unity of change depends upon unbroken progress to a single goal.

(37) We might say that the motion of the twig is accidental change, since it comes about neither by nature nor purpose, but by the chance contact of two independently behaving entities. But accidental change is still change. The twig is being moved, therefore ordinary logic would invite us to infer that it is in motion. Aristotle's failure to take account of this type of case is due, I should suppose, to his general tendency to bind the concepts of cause, scientific account, and definition together in a tight package. In the first place, all changes (including purposive ones) can be shown to depend ontologically on natural change (*v.s.* Chapter I, paragraph (45)). Secondly all change is either natural or unnatural, and therefore depends conceptually for its description as such on the concept of natural change. Thirdly, there is no scientific knowledge of the accidental.²⁶ For the accidental is the conjunction of what already can be traced back to nature or purpose, so that apart from the statement of the conjunction itself, no extra explanation is needed for the accidental. These three propositions we might be willing to accept, since they express

26. Cf. *Metaph.* E 2, 1026b2 ff.; K 8, 1064b15 - 1065a6.

a scheme which supplies explanations and verifiable predictions of a good range of phenomena, and to that extent deserves some scientific respect. But from these propositions, it appears, Aristotle tacitly draws the conclusion that the accidentally caused need not fall under any definition. In particular, accidentally caused change need not fall under the definition of change, which accordingly is framed so as to leave it out. And yet an accidental locomotion (this case is perhaps the most obvious) may share all the spatio-temporal properties of its recognised natural or purposed counterparts. We cannot say that the twig is not in motion. In fact it is more obviously so, most of us would think, than the man standing on the doorstep. But the furthest that Aristotle's system would allow him to go in accommodating this type of case, would be to say that the twig, though not in motion by the III 1 definition (nor at rest), participates in the animal's natural motion in which it is physically involved. Aristotle never makes this move. The problem, it seems, simply escaped him. It is strange that a philosopher whose genius lies in creating conceptual status for what one might call metaphysical hangers-on (so that not everything real has to be a substance or actually whatever it is, and process too can be shown to be a reality, though definable in terms of more primitive concepts than itself) should so totally have overlooked the multitude made homeless by his own definition of change.²⁷

(38) We may sum up our criticism of the III 1 definition as follows. Not only does it fail to convey what is common to all change, but in

27. Aside from accidentally caused change, the definition of III 1 poses a serious problem for the eternal rotation proved in Book VIII. *V.z.* Chapter V, paragraphs (43) ff.

confining itself to change that stems from a particular type of cause (that which determines an intrinsic direction), it provides a concept operative only on the level of explanation and therefore fails to capture change as immediately perceived. Until we have reason to believe that a nature or purpose is the principle of a given phenomenon we have no ground for classifying the phenomenon as a change at all by this definition. Again, until we know what substantial nature or purpose directs the change, we do not know whether the subject is changing, even in the restricted sense of the definition. If a load of bricks is on the ground, then from the point of view of their own nature they are not in process, but in their material's proper place. From the builder's point of view, they are "on their way" to a place destined by his intention (positions in a vault as yet unbuilt). The same relativity affects the concepts correlative to "change", those of "enforced rest" and "natural stasis". From their own "point of view" the materials of a bird's nest are in enforced rest; from that of the agent they are in the condition that naturally terminates the active process that got them there. This relativity does not give rise to logical contradiction or any kind of absurdity, but it does entail the impossibility of knowing whether an object is or is not in process until the total situation is understood and all the relevant agents' parts in it identified. The definition fails to elucidate any sense of 'change' that can readily apply to perceived events even before it is known what they or their principles are.

(39) Such being the limitation of the analysis in Book III, it is not altogether surprising to find Aristotle elsewhere mounting another attack on the problem of change. I refer in particular to the dis-

cussion of *Physics* Book VI, where he approaches the question on an entirely different conceptual level. The failure of III to provide an account of change and process in general was due to the pervasive influence of the concepts of substance and nature. But in VI, by contrast, these metaphysical concepts have sunk out of sight, and the analysis depends instead on the ideas of time, space and the magnitude of the changing subject. These are indeed, as he says in III 1, 200b 2-3, common and universal properties. In particular, they are common to all physical changes. So it is evident from the start that Aristotle's conclusions in VI will apply as much to changes undictated by nature or artifice as to their opposites. Here then we might perhaps hope to find an improvement on the élitism of the definition in III.

(40) We have, it is true, no reason to think that Aristotle himself at any stage saw that definition as defective. But the existence of Book VI shows that at some point (whether earlier or later²⁸) he believed that change could be profitably discussed from a point of view altogether different. Yet the Book III conception is the one to which in the end he returns (if he ever left it), in Book VIII.²⁹ Moreover Aristotle never departs from the fundamental assumption of the Book III definition, *viz.* that change is properly to be described as process: not as emergence, but as emergence-led-up-to, where the leading-up is itself the change, or rather the changing. This assumption, we saw, was necessitated by the metaphysic of "nature", but it is present even in VI where that metaphysic is least in evidence. Now

28. Ancient tradition assigns Books III and VI to different works. See Ross, *op. cit.*, pp. 1-8.

29. Internal evidence makes it clear that VIII postdates both III 1-3 and VI.

the concept of process has two aspects, each represented in III 1: a process is (a) of a different structure from a non-process-actuality, but (b) in common with the latter it has a unity and identity of its own. The rest of this chapter centres on the question whether in VI Aristotle succeeds in developing a non-metaphysical concept of process that does justice to both aspects. I shall argue that the account of Book VI fails because it analyses the first in terms that make nonsense of the second.

(41) Assuming that change is to be regarded as essentially a changing, the problem as always is how to characterise this. On such a view, change necessarily occupies time, so how is it distinguishable from non-process conditions, which also last for a time? In III 1, relying on the concept of "nature", Aristotle was able to define process in a way that did not entail either that process is mathematically continuous or that it is temporally intermediate between its *termini*. But if process is not to be distinguished from non-process in metaphysical terms, what is left but to attempt a distinction in temporal terms, by reference to temporal structure and position? Thus the focus of discussion shifts from the "negative" element of the III 1 definition to infinite divisibility, while the metaphysical dependence of change upon its *terminus* is replaced by temporal intermediacy. On reaching Aristotle's discussion of Zeno's paradoxes in Book VI, the reader of the *Physics* may find it surprising that Aristotle, with his unparalleled sensitivity to differences of conceptual level and his constant insistence that each subject-matter be treated in terms proper to itself, should have so enthusiastically accepted Zeno's initial assumption that the concept of mathematical *continuum* can be applied to physical space, time, and motion. We should

have expected Aristotle to make at least some move to question this,³⁰ even granted that his main concern in VI is to meet the paradoxes on their own terms. But his attitude becomes more intelligible once we see that the concept of the *continuum* seems to provide him with exactly the materials he needs in order to make out afresh the distinction between process and non-process. A process necessarily lasts for some time, as do non-processive or static conditions,³¹ but the difference between them lies in the temporal variegation of the former. A single process has many stages, each different from the last, so that at each stage in the life of the process something different is true of the subject; which is just what cannot be said of a static condition, since as long as it lasts, what is true of the subject is at each moment the same. And since the difference between process and static condition is assumed to be absolute (it is still the difference between being and becoming), an adequate account must rule out the possibility of reducing process to a series of static conditions. Thus

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30. Cf. G. Vlastos, 'Zeno's Race Course', *Studies in Presocratic Philosophy*, edd. Allan and Furley, vol. II, p. 218, note 25 (the article first appeared in *Journal of the History of Philosophy* IV, 1966): 'To humour Zeno's claim that the sequence of Z-runs is infinite we must allow that any point reached after traversing a finite number of Z-intervals would be physically distinguishable from the terminal point, G, as also from infinitely many intermediate points.' Aristotle is not in the habit of humouring his adversaries; that he does so here requires some explanation.
31. These terms are not synonymous, although they will be so treated for the rest of this chapter. "Process" has two contraries, (a) "static condition", and (b) "complete (or "perfect") activity", as for instance (in Aristotle's view) thinking and perceiving. The contrast between "process" and (b) makes sense only in the context of the Book III definition from which process emerges as incomplete activity. Complete activity (it is clear from Aristotle's examples in *Metaph.* Θ 6) does not entail stasis in the sense of a condition uniform in content through the period of its duration. But in a context where the temporal variegation of process is being stressed, the relevant contrast is between it and (a).

the concept of mathematical continuity, entailing as it does that between every two points dividing the whole there is another point, seems the ideal tool for Aristotle's purpose. A process to P and a static condition S have one thing in common: given the infinite divisibility of time, for each instant I after the beginning there was a prior instant when the subject was already changing to P, or was already in condition S. But the difference is that being S consists in fulfilling the same description all along; whereas changing to P, Aristotle tells us at length and enthusiastically in Book VI 6, consists in having reached, at each instant, a different new condition along the way. Now to reach a new condition is to have changed or been in process, and for every new condition reached, there was a process of reaching it. Therefore, within the temporal bounds of any one process to P there have been infinitely many different processes forming a nested set, one for each new stage reached in the course of reaching P. As Aristotle says at VI 6, 237a26 - 28:

'In half the time it will have performed another change ('ἄλλο ἔσται μεταβεβληκός') [*i.e.* other than what it performs in the whole time], and in half of that another, and so on *ad infinitum*'.

(42) A process to P, then, is a passage along an infinitely graduated series. The grades are grades in one and the same medium or dimension, and the *terminus ad quem* P is itself another such grade. In any selection of grades or points that we care to take, the members are specifiable in systematically related terms: they are all points in the one medium, and each is uniquely designatable by a formula of the same conceptual type, giving the ratio of its distance to P's distance from the starting point. Thus the process to P is unitary because however many different stages in it we care to identify, they

are all systematically related by a single mathematical ordering. Let us briefly contrast this unity with that of a process under the III 1 definition. That definition applies to processes described in terms of mathematical continuity; but also equally to processes considered as having conceptually heterogeneous stages. Thus house-building involves a number of quite differently describable operations, some of which (*e.g.* waiting for the mortar to set) display no visible on-going-ness. What makes it all a unified process is the same as what makes some apparently static condition a stage in the process, *viz.* that all these heterogeneously describable actualities are true of their subject on account of one and the same potentiality for one and the same end-state. They are, in other words, all stages in the same actuality or activity, since the potentiality exercised is the same.

(43) On the mathematical schema, the process must take place in a temporal interval between the times when the *terminus a quo* and *terminus ad quem* contraries hold of its subject. These contraries lie in the same conceptual range as each other: if one is a spatial position, so is the other, if one is a magnitude, the other is too, etc. The same is true of the properties corresponding to the stages of the process itself. That is to say, if the process had stopped at some point before its actual stopping point, the subject would have found itself in possession of a property on the same range as (because "between") the actual terminal properties. But different properties on the same range are logical contraries. It follows that a subject cannot at the same time possess the property that functions as *terminus a quo* and be in process to the *terminus ad quem*. For if the process

had stopped half-way, the subject would have displayed a property intermediate on the range, and this is by construction other than but on the same range as, and therefore contrary to the *terminus a quo*. So the occurrence of process necessarily presupposes having left the *terminus a quo* (and by a similar argument, having not yet reached the *ad quem*). But on the account of Book III there is no such necessity for the process to be temporally intermediate between contraries. A dish of water is put into the freezer: suddenly its surface is frozen.³² (If we think of this as the culmination of a gradual process, it is on account of an empirical explanation in terms of particle-structure which was unavailable to Aristotle.) Was there then no time-taking process? The III 1 definition permits us to say that there was one. It consisted in the water's simply standing in the place concerned, and this was a process because that standing was on account of and grounded in the subject's not yet being in the state in which standing there it would come to be. But the process in this sense is not incompatible with the subject's still being in the *a quo* terminal condition of liquidity. Being liquid is not logically contrary to standing in a certain place. On this account, the process is still of necessity temporally prior to the realisation of the *terminus ad quem*. But while it presupposes not having reached the latter, it does not presuppose having left the former, the *a quo*. In this way there can be process and contrary *termini* without the process filling a temporal interval between the *termini*.³³

32. Cf. *Physics* VIII 3, 253b25 - 26.

33. O. Hamelin, *Le Système d'Aristote*, p. 308, writes as if Aristotle's one concept of process were the temporally intermediate one: 'Ce qu'il y a de plus essentiel dans le changement aux yeux d'Aristote, ce ne sont pas les deux contraires qui lui servent de limites, c'est

(44) So change analysed in terms of the mathematical *continuum* turns out to have a structure very different from that of change as metaphysically defined in Book III. We now have to consider whether the former account succeeds any better than the latter in capturing the meaning of change as such. Since locomotion most obviously illustrates the continuity model, it is no surprise that so much of the discussion in Book VI should revolve round locomotion and its conditions. Yet Aristotle makes it clear that the doctrine that contrasts change with the static in terms of the former's infinite temporally nested variety is to hold for change of all types: see VI 6, 237a34 ff. So it is the universal character of change as such to be mathematically continuous and hence to occupy a temporal interval between its *termini*. But there is a difficulty which Aristotle himself notes, although his response to it leaves much to be desired, as we shall see shortly. The problem is that not all properties are members of continuous ranges. Qualities, he says, are 'indivisible' (VI 5, 236b1-6), which amounts to saying that it is not the case that between any two contrary qualities there is another contrary. In this Aristotle is surely right, for in what sense of "is" could it be credibly maintained that there always is an intermediate? A perceptible change of quality may involve a perceptible gradation between the *termini*, but perception cannot discern another shade between every pair of perceptibly distinguishable shades. Nor have we, as with spatial position and magnitude, a mathematical method of designating an intermediate for every pair, in terms of fractions of some size or distance. And in any case, even if theoretically a quality could be found between any two

l'intervalle de progrès qui s'étend entre ces deux limites, et cet intervalle est, selon lui, continu.'

contraries, in what sense are the intermediate qualities actually passed through in a qualitative change? The nature of space dictates (or so we assume) that all positions on a line must be passed through by an object moving from one end of the line to the other, so that if the passage had been halted after any given temporal fraction of its actual duration, the object would have been somewhere. But even if between any two musical tones there is an intermediate in the sense that a tone could be produced lower than one and higher than the other, it does not follow that a passage from F to A for instance must "go through" all these, as if a player could only ever move *glissando* from F to A.

(45) Yet Aristotle maintains (VI 6, 237a35 - 237b2) that even in qualitative change, what changes has already performed another change, and in performing this had already performed another, etc. His argument is that although the respect of change is indivisible, the time of the change is not (237b2-3). But this assumes that the change did take time between its *termini*, and why should we assume this? For Aristotle, I suggest, the fundamental reason is that he hopes to discover in the infinite divisibility of change into smaller changes a universal criterion contrasting change with the static. If this fails to apply to qualitative change, then qualitative change is not change, but a mere succession of static conditions. Thus becoming is not in general a different type of actuality from being, but a temporal arrangement of being. But Aristotle cannot take it for granted that possible opponents will automatically accept the mathematical continuity criterion as applying all across the board. Having admitted himself that qualities are indivisible, he has the onus of showing that

qualitative change is nevertheless divisible. An atomist opponent, for instance, would be a fool to let Aristotle walk away with this point. The alert atomist, unless given a demonstration to the contrary, will assume that the indivisibility of quality entails the indivisibility of qualitative transition. For in a context of discussion where mathematical continuity is being stressed as the characteristic of change, he can then argue that there are no qualitative changes, or alternatively that qualitative change exists only because it is really (= reducible to) quantitative or positional change, thus reinforcing his own doctrine that all is atoms in their various shapes, spatial arrangements and motions.

(46) It is for Aristotle, therefore, to argue that even qualitative change takes time between its *termini* (so that the change is "divisible" because the time is). And he does argue.

'Not only is it the case that what changes (τὸ μεταβάλλον) has changed, but it is also the case that what has changed was changing before. For whatever has changed [*i.e.* completed a change] has changed in a period of time. To see this, suppose that it has completed the change from A to B in an instant. Then it has not completed the change in the same instant in which it was at A, since in that case it would be in A and B at the same time. This is supported by our earlier conclusion that what has changed, when it has changed, is not in the *terminus a quo*. But if it has completed the change in a different instant from that in which it was in A, then there is a period of time between, since instants are not together. So since it has changed in a period of time, and all time is divisible, in half the time it will have performed another change, and by the same reasoning in half of that another, and so on *ad infinitum*, so that it was always changing prior to having changed.' (VI 6, 237a17-28)

(47) The earlier conclusion referred to was reached in 5, 235b6 ff., where Aristotle argued that whatever has changed has left (*ἀπολείπειν*) the *terminus a quo*. Now both here and in the later passage just quoted we note that Aristotle uses spatial terminology. In particular, in speaking of the object as being at or in (*ἐν*) the *termini* A and B, he invites us to think of them as places, therefore as spatially distant, so that the passage from one to the other is through space and takes time. But since his avowed purpose is to prove that all change is, like locomotion, temporally intermediate between *termini*, not to beg this question, I shall interpret him as meaning that the object changes from being P to being Q, where 'P' and 'Q' may be replaced by spatial predicates, but also by quality-words like 'black'. And discounting the spatial metaphor, I shall take it that 'X has left being P' means simply that X is no longer P.

(48) The argument in VI 6, 237a17-28 rests on the Law of Non-contradiction. It is because 'P' entails the contradictory of 'Q' that the subject of change cannot be P and Q at the same time, and must no longer be P (must have "left" being P) once it has effected the change to Q. Therefore, Aristotle argues, the P-state and the Q-state cannot be immediately consecutive, since the instant of transition would be an instant in each state, the first of one and the last of the other, so that at that instant the object would be P and Q. Hence there cannot be an instant of transition:³⁴ there must be a

34. On Aristotle's handling of this concept see G.E.L. Owen, 'Τίθεναι τὰ φαινόμενα', *Aristotle*, ed. Moravcsik (first appeared in *Aristote et les Problèmes de la Méthode*, ed. S. Mansion), pp. 167 ff., esp. pp. 177 ff., and R. Sorabji, 'Aristotle on the Instant of Change', *Aristotelian Soc. Supp.* L, 1976, pp. 69 ff.

period of transition between the terminal states, and it is the "between-ness" of this period that saves the subject from being both P and Q when it changes. But the argument proves too much. It proves that there can be no instantaneous transition from any condition to its own contradictory. Where P and Q are contrary terminal states, there may be a finite interval of transition between them, as for instance if they are different spatial properties. It is this that gives the argument the semblance of plausibility. But there cannot be a finite interval between not-Q and Q, or at any rate not for Aristotle, who holds by the Law of Excluded Middle (*cf.* VI 5, 235b 15-16). But even if the Law of Excluded Middle were ignored and we found ourselves able to assert that an object might be neither Q nor not-Q while it is becoming Q from not-Q, the reasoning would make change impossible. If there has to be a period of transition between not-Q and Q because an instantaneous transition would entail the object's being both contradictories at once, then there cannot be instantaneous transition from not-Q to N (where 'N' = 'neither not-Q nor Q') or from N to Q, since 'N' and 'not-Q', and 'N' and 'Q' are no less mutually exclusive than 'Q' and 'not-Q'. So there must be a period of neither not-Q nor N between not-Q and N, and so the argument would go on, proliferating to infinity the number of finite temporal periods required by any single change.

(49) Aristotle himself saw the difficulty, strangely enough, in the chapter preceding his proof that a change between contrary *termini* always occupies an intervening period. His problem there was the transition from rest to process. An instantaneous transition seems to entail a moment when the object is both at rest and in process. But

this time Aristotle cannot step out of it by postulating a non-instantaneous transition between rest and process. This would produce the infinite regress. His answer consists in the assertion of instantaneous transition together with the denial that this concept implies a moment when the object has both the properties characterising the periods on either side. The object, he says, must not be described as in process of changing at the instant in question. It is changing from this instant, and at every subsequent instant (up to the latter end of the change) it is true of it that it has already been changing. However early a subsequent instant we select, there was always an earlier (yet one still later than the instant from which it was true that the object was changing); thus he is able to phrase his conclusion as: 'There is no moment which is the first at which the thing has changed'. (VI 5, 236a25 - 26)

(50) Here, then, Aristotle breaks the paradox by refusing to allow the inference from 'Instant I limits the period during which X is in process' to 'Instant I is a moment when X is in process'. In this way he can ensure that rest and process are immediately consecutive without being committed to a moment when both are happening. How was it that he failed to see that the same treatment could be meted out against his own *a priori* argument in VI 6 refuting instantaneous transition between contraries? The situation here is different, in that logic does not forbid a time-taking transition. But there need not be one; or at any rate Aristotle has not shown that there need. For the argument by which he tries to do so can be defused by treating the supposedly impossible instant of instantaneous transition as a limit in the sense just explained: *i.e.* in the sense in which 'being a

limit of the period during which X is P' does not entail 'being a moment when X is P'. Aristotle's failure to realise this is not easy to explain. It rests in part, I suspect, on some buried assumption concerning the conceptual relations between 'limiting instant' and 'process', and this is an area which I cannot at present attempt to discuss. But if he had seen clearly the apparent discrepancy between his treatments of rest-to-process transition in VI 5 and contrary-to-contrary transition in VI 6, he would surely have tried to bring the buried assumption to light. As it is, there is no sign of awareness that any unearthing might be in order. And this, I suggest, is due to his conviction sustained throughout Book VI that (metaphysics being for the moment in abeyance) mathematical continuity provides the one key to the difference between change and non-change. The transition from rest to process cannot be classed as change: anyone who says otherwise runs against the paradoxes that supposedly vitiate the idea of "change of change" (*cf.* V 2). But transition from contrary to contrary is change. A static condition "contains" within its own duration nothing but shorter periods of the same condition. But a change, according to VI, "contains" infinitely many shorter and different changes. To differ in the required manner from stasis, change must be mathematically continuous, and therefore (as we saw; *cf.* paragraph (41)) it must be temporally intermediate between its *termini*.³⁵

35. Aristotle's attempt to apply this analysis to all types of change, including qualitative, runs into a further difficulty consequent on his account of time in Book IV. There (IV 11, 219a10-19; 220a1-11) he argues that the divisibility of the time of a κίνησις derives from the divisibility of the κίνησις itself, which in turn is seen as having μέγεθος on account of its traversing a divisible spatial interval; *cf.* G.E.L. Owen, 'Aristotle on Time', *Motion and Time, Space and Matter*, edd. Machamer and Turnbull, pp. 3 ff.; esp. pp. 19 ff. But in VI 6, Aristotle's general thesis requires him to revise the conceptual order, at least in the case of qualitative change. Since this

(51) We have examined one lacuna in the Book VI account of change. The mathematical schema that is supposed to apply to change as such, and, if I am right, to define it, fails to cover change in quality. We have still to consider a group of more serious difficulties, problems that cast doubt on Aristotle's whole project of analysing change in terms of mathematical continuity. I say 'Aristotle's project', for the following discussion does not show that there could be no coherent theory making continuity the crucial notion in an account of change. But it is doubtful whether such a theory is possible for Aristotle, because it has no place for the fundamental assumption never discarded by him even in VI, that the direction of change is to be identified by reference to some terminal property. A change is still essentially a change to something or other. This entails that once the property has been realised, whatever happens thereafter (except in one special case) is not the same change or a continuation of the same change that brought about the realisation of this property. Inevitably, then, if circumstances remain the same, the object will stop changing once that point is reached, for to go on would be to go on without direction, which is impossible, and if it acquires a new direction, this can only be because something new has happened to prompt change in a new direction. The exceptional case just mentioned is that of circular motion, in which as Aristotle says in VII 8, 264b10 - 13, the *termini a quo* and *ad quem* are identical. The directionality of circular motion does not entail its eventual ceasing, because in this one case, the object never reaches a point such that "going on

is in an "indivisible" respect, his only ground for asserting that the change itself is divisible ("contains" lesser changes) is that its time is. Thus in this sort of case he treats the divisibility of time as prior to that of change.

changing" either implies changing without direction or presupposes the emergence of a new factor determining a new direction. Once the object has completed a circle, it can without break still continue to perform as before, because the terminal point (whichever point on the circle we choose to identify this with) is always still there for it to reach if it continues the same pattern of motion.

(52) Consideration of circular motion brings out an ambiguity in '*terminus ad quem*'. In all but this one case the expression stands for the property which (a) defines the direction of change; (b) is that in which the change actually terminates. But in circular motion, the *terminus ad quem* (once it is specified to be identical with the *a quo*) fills the first of these rôles but not the second, so that here they are distinguishable as nowhere else. From now on, however, I shall be concerned with the changes that necessarily terminate at their *terminus*, and the question is whether these can after all fit into the schema of Book VI. But before going further it would be as well to make sure of my claim that in VI as elsewhere Aristotle still clings to the notion of non-rotatory change as essentially self-terminating. A glance at Chapter 10 is enough. Here Aristotle shows that his position regarding change is essentially the same as his position on magnitude. Magnitude is infinitely divisible, but there could be no infinitely great magnitude; change too is infinitely divisible, but (with the exception of circular motion) every change must be of limited duration. This follows from the principle that a change is from something to something (10, 241a26 ff.); *i.e.* that change necessarily has direction. He then adds an argument which strikingly illustrates the assumption that having direction means

changing to the realisation of some one given property.

'Consider something that cannot be cut, in the sense of not possibly being cut (for "cannot" has different senses). Something that "cannot" in this sense is not possibly cut, and in general what cannot happen is not something that possibly happens. Nor is it possible that what cannot change should change to that to which it cannot change. If then something in locomotion is in process of change to a certain place, then it will be something that can also carry out this change. So process is not infinite, and the object will not be in locomotion infinitely, for it cannot traverse the infinite.' (241b3-11)

The only reason, Aristotle assumes, why something should be supposed to go on changing (*e.g.* moving in a straight line) for ever (or for ever unless interfered with) is that the position to which it changes is infinitely far removed: but this, he says, is nonsense, for it cannot reach that position; but something cannot be said to be changing to a point at which it could never be; hence change is intrinsically finite. But suppose direction of change were identified otherwise than by reference to a single property or position reached; for instance by a formula determining a series of positions? Aristotle is still as far from this conception in Book VI, for all its non-teleological, unmetaphysical approach, as he ever was in II and III.

(53) Let us now draw out some consequences of the Book VI conception of all change as involving the prior performance by the subject of a different and "smaller" change in half the time, etc. Except in the case of circular locomotion, we obtain the following results.

Firstly: Every change takes infinite time. Argument: A change K_1 from A to C is supposed to "contain" a temporally shorter change K_2 from A to B. K_1 and K_2 are different changes because their *termini ad quo* s differ, thus giving them different directions. Given that

K_1 , being directed to C, should terminate at C, it follows that K_2 , being directed to B, should terminate at B.³⁶ So the subject must stop changing at B. Even if it starts again on its way to C, the stop will have taken time. But at every stage there will have been such a stop, and there are infinite stages. But what if we seek to evade the conclusion by saying that the subject need not stop at B even though it does change to B (so that it is still true that the change to C "contains" a specifically different change, the one to B)? Granted this, if B is a direction-giving *terminus* but not *ipso facto* a point of termination, why should the same not be true of C? In that case, (a) the subject need never cease changing (unless hindered); and (b) since it can continue to change after reaching its direction-giving *terminus* C, whether or not anything has arisen to give it a new direction, it follows that it can change without direction.

(54) Secondly: There is no such thing as a change. Argument: A change K_1 from A to C is supposed to "contain" a temporally shorter change K_2 from A to B. But these are different changes, and at B the change which the subject had been undergoing, *viz.* K_2 from A to B, is over. So it is only now that it begins a change other than K_2 , namely a change to C from B. Let us call this change K_3 , for although it has the same *terminus ad quem* as K_1 , it has a different *a quo*. It is now clear that "the" original change K_1 , which was supposed to be a unit containing the smaller unit K_2 , is not a unit at all, but a sequence of two changes, from A to B and from B to C. But these two consecutive changes are not a change, since they have no single

36. Cf. *Physics* VIII 8, 263a23 - 31.

direction. Moreover this argument shows that at no point does any change to C even begin. It did not begin from A, as originally seemed to be the case, for the change that did take place from A was not to C but B. We therefore said that the change to C began at B. But of course it did not really. What began at B was a change to some point short of C, this change being "contained" by the change K_3 , just as what began at A was not a change to C after all, but one to B. So no change to C ever begins (by infinite repetition of this argument), nor any change to any other *terminus*. This reasoning holds whether or not we suppose (as in the previous argument) that the subject must stop for a time at each *terminus ad quem*. However, it may be objected that these absurd consequences follow only on the assumption that a subject cannot be undergoing two differently directed changes at the same time. If this is possible, then there is no reason why we should not say that while changing from A to B, it is also changing from A to C. In that case, the change from A to C remains "whole", and has a beginning at A. If however this move is allowed, there is nothing to bar the conclusion, which for Aristotle is self-evidently impossible, that something could undergo opposite changes (*i.e.* changes to opposite *termini ad quos*) at the same time.³⁷

Suppose something first becomes sick, then becomes healthy. There is nothing absurd about this as long as it is understood that the becoming

37. For the concept of opposite changes, see *Physics* V 5. For the impossibility of the same subject simultaneously undergoing them, see VIII 7, 261b5-6, 20-22. For the inference to the conclusion that where C_1 and C_2 are contrary changes, one cannot be part of the same continuous change as the other, see VIII 7, 261b6-7. Here Aristotle claims that there is an intervening period of stasis. This is due partly to his assumption that the changes are natural (hence naturally terminate in natural stasis), but also to a reification of the conceptual point that one change must be over before the other begins.

sick is over and done with before the becoming healthy begins. But if it is possible for something to be undergoing one change K_2 , and at the same time another, K_1 , to a different property on the same range, there is no reason why it should not be simultaneously undergoing changes to opposites. For we could regard the becoming sick as the temporally shorter change which is "contained" in the larger and already on-going change to health. If this is nonsensical, then the change to health must be described in such a way as not to entail that it or any temporal sub-stretch of it coincides with the change to sickness; and this can only be achieved by stipulating that the change to health does not start until after the change to sickness is complete. Thus again, we get two consecutive changes, not one unit "containing" another.

(55) These absurdities arise only on the assumption that direction of change is given by the *terminus ad quem*. If we define direction by a formula covering all stages on a given range, then the statement 'If X has changed from A to C, then X has changed from A to B' does not imply that if X has changed from A to C it must first have stopped at B. For unless 'X changes to -' gives the direction of change, there is no reason why in changing to Q, X must be going to stop at Q. If Q does not give the direction, then the subject has not, by reaching Q, exhausted its change in that direction, so that it must either stop or go on without direction. Again, if direction is specified by a formula covering all the stages on a range, then if a pair of opposites could be brought under a single formula, the second difficulty cannot arise. It is not clear what this could mean in connection with health and sickness (an example which therefore favours Aristotle's

position). But other examples he gives of opposite changes are motion upwards and downwards.³⁸ Here the *termini* could be brought under one formula, and if this formula, rather than any one *terminus*, defines the direction of change, then the object could coherently be described as going upwards while it is going downwards, since the down-most point is only a stage on the way upwards. It is not opposites as such that resist this treatment, as the up-down example shows, but only opposites that do not lend themselves to mathematical formulation. And in general, when the direction of change is given by a single formula covering stages A, B, C, etc. (which being on the same range are contraries in the logical sense, even if not opposites),³⁹ there is no absurdity in the idea that the object changing from A to C is also changing from A to B: this is the same change, since the direction is the same. The phrase 'A to B' describes that change as it was when it had only got as far as B; it does not, on this view, describe a specifically different change which occurred somehow tucked away inside the A to C change without (*per impossibile*) threatening the latter's own unity and identity.

(56) Some time after he composed Book VI Aristotle's cosmological concerns generated a problem whose solution, as he saw it, cost him the conclusion so proudly iterated in Book VI 6, that whatever completes a change has completed an infinite number of other changes. For cosmological reasons, there must be some change that is everlasting (*Physics* VIII 6, 260a17-19). What kind of change could it be? For

38. Cf. *Physics* VIII 8, 261b34-36.

39. Cf. *Physics* V 5, 229b14-21.

Aristotle, this amounts to the question: How can there be change with direction but without termination? In effect, the problem of the eternal change forces him to clarify his own conception of the relation between "change" and "*terminus*". As a result, circular locomotion emerges as the one type of process capable of filling the bill (*Physics* VIII 7-9). But along the way Aristotle comes face to face with the conceptual absurdities generated by his earlier attempt to analyse change in terms of infinite divisibility while still retaining the notion of *terminus* as source of direction. Theoretically, it might be said, Aristotle had a choice: he could have abandoned the connection between direction and *terminus*. But there is no sign that he even saw this as an alternative, and it is the account of VI 6 that has to go. The lesson of the paradoxes displayed above is that one completed change is not a Chinese box of other completed changes, and any hope of spelling out in this way the difference between process and the static must be set aside. The most that can be said is that in any single continuous process, *e.g.* locomotion, the total distance covered contains potentially the halves, quarters, etc. of that distance. That is to say, we can (mentally or physically) divide it. But it does not therefore actually contain or consist of halves, etc. (VIII 8, 263a11-263b9) Nor does it if it is divided, for then there is no "it", not one distance but two, or however many. And what is true of the distance is true also of the change. An actual change that took time could have stopped (been divided) half-way. But it does not follow that if not "divided", the whole actually has that half-change present in it. And as with space, if the division did take place, so that the lesser change was the actual one, it would not be an actual half of a larger change, because the larger one would not have happened. If the parts are actual, the whole is not (in which

case they are not properly called parts), and *vice versa*.

(57) With regard to space, Aristotle draws the conclusion:

'One who moves continuously has traversed infinite stages *per accidens*, but not strictly speaking. For it is *per accidens* that the infinitely many halves [halves of halves, etc.] are in the line, whereas its essence and being are different.' (VIII 8, 263b6 - 9)

A line along which a man travels is not definable as halves, quarters, etc., any more than an animal is definable by reference to the substantial natures of the simple bodies that are "in it" in the sense that they would emerge on decomposition.⁴⁰ Similarly with respect to change: what a given change is, is not any or all of the lesser changes any one of which would have occurred through interference at the appropriate stage along the way. It is absurd to define something actual in terms of the remnants that would have been left of it had it been destroyed or prevented from fully being. Thus infinite divisibility cannot give the essence of change, even if it is a universal (and necessary) fact about it. However, once it is clearly seen that infinite divisibility does not give the essence, there is no longer the pressure felt in Book VI to insist that infinite divisibility is even a universal property. In any case the essential difference between change and non-change must be made out anew (or rather, by recourse again to the analysis in Book III), and although infinite divisibility is interesting, its interest cannot lie in its telling us the essence of change; so it no longer matters if there is reason

40. Cf. Simplicius, Diels p. 1293, 3-5: 'κ'αν ὀρίζομεθα ... τὸ συνεχὲς τὸ δυνάμενον ἐπ' ἄπειρον διαιρεῖσθαι, τὸ ἐνεργεῖα δὲ κατὰ τὸ ἐν αὐτῷ δυνάμει ὀρίζομεθα, ὡς εἴ τις τὸν ταῦρον ὀρίζουτο τὸν δυνάμενον μέλισσαν γένεσθαι.'

to doubt whether all change is infinitely divisible.

(58) It is no accident then that immediately after concluding the argument just examined, Aristotle turns to redefine his position with regard to the paradox of the transitional moment. In VI 6 he had argued that change necessarily occupies an interval between its *termini*, since otherwise there would be a moment when the object had both terminal properties at once. He put more trust in this argument than it deserved because of his current conviction that the essence of change was mathematical continuity, which entails temporal betweenness. But if change need not be mathematically continuous, nor need it occupy time between the *termini*. So Aristotle is now free to muster precisely the argument which in VI 6 he so oddly ignored. And his present example is qualitative change, just the kind to which the mathematical schema was least appropriate and was only made to seem so at all by dubious reasoning. In VIII 8, 263b9 - 264a6 he states that we must avoid saying that when something changes from white to not-white, it has both properties. But this, he argues, is done if we refuse to treat the moment of transition as a moment shared by the periods which it divides. Since (he assumes) something must be true of the object at that moment, let us say that it then has the property to which it has changed. (For at that moment it has changed, hence has the property to which the change was a change.) So at the moment of having changed the object is not-white. But there is no need to say that it was then also white. 'The moment belongs already to the later period' (263b21).

(59) It is true that Aristotle conducts this argument in terms of a quality and its contradictory, not contrary qualities. Thus it might be thought not to constitute a direct rejection of VI 6, 237a 17-28, since that passage was concerned with transition between contraries. In VIII 8 Aristotle is saying that if we describe a change as a transition between contradictories, then there cannot be a period of time between the two; but the instantaneous transition presents no paradox provided we look upon the instant as a limit. And in saying this, it may be thought, he does not deny that change between contraries occupies an intermediate period. The moment the white object ceased to be white it would be not-white (have "left" being white); but this does not entail that the change to the terminal contrary colour is complete as soon as the subject has ceased to be white. But the present passage cannot be reconciled with VI 6, 237a17-28 in this way. For the position there was that change from contrary to contrary occupied a time between the times when the object had first one contrary, then the other. Aristotle's words in the present passage contradict this. At 263b21-23, he says:

'If the not-white was coming to be or the white ceasing to be in the whole of the period preceding the moment of transition, then at that moment the coming to be or ceasing to be was complete.'

The context shows that Aristotle is implicitly asserting the antecedent of this hypothetical. He continues (263b23-24):

'So at that moment it is first true to say that the object is white or not-white [*sc. depending on whether the change was from white to not-white or vice versa*].'

Suppose that it is from white to not-white. Then, Aristotle says, the object is white up to the moment of transition, when it is first true to call it not-white. But he has also said that the not-white was

coming to be and the white ceasing to be throughout the period before the transition. Thus he is willing to describe the pre-transition situation as one in which the object both was white (was "at" the *terminus a quo*) and was ceasing to be white or becoming not-white. This description we saw to be coherent (even on the assumption that the change is a time-taking process), given the III 1 definition of change (*v.s.* paragraph (42)). Aristotle has already proclaimed in Book VIII his loyalty to this definition (1, 251a8-10; 5, 257b6-9). That loyalty we have no reason to believe him ever to have renounced, but at one stage perhaps he thought that the accounts of Books III and VI would usefully supplement each other. But the possibility of any such co-operative relationship is precisely what these latest arguments of VIII 8 rule out.

CHAPTER IV

Agent and Patient

(1) We turn now to the most puzzling part of Aristotle's theory of change, the topic of agent and patient. It is difficult to determine his position on this matter, and difficult to see its philosophical sense. Yet these problems have a special claim on the attention of anyone concerned with his notion of change, because for Aristotle, "agent-patient" more than any other concept is bound up with his account of change itself. The connection is so close that his analysis of change can hardly escape the reach of such charges of confusion and obscurity as might be levelled against his views on agency and patiency. No one would dispute the latter concept's relevance to change, any more than the relevance of space, time, infinity and the problems of the vacuum (*cf.* III 1, 200b15 - 25). But Aristotle does not deal with agency and patiency as he does with these, devoting to each on its own a methodical discussion whose beginning and end are clearly marked. This procedure means that the original definition of change in III 1 enjoys a certain measure of immunity from difficulties arising independently in connection with these separate studies. But his remarks concerning agent and patient in III 1 - 3 are so embedded in the discussion of change itself that it is hard to resist the impression that for him the two notions stand and fall together.

(2) We have seen, for instance, how he refers to agent and patient, changer and changed, even at the very moment of introducing the definition of κίνησις (200b25 - 32; *v.s.* Chapter III, paragraph (20)).

And he has no sooner proposed the definition than he turns briefly to the question 'Is the agent of change necessarily also a patient?' The definition is then discussed in detail and compared with accounts of change in earlier thinkers. This leads, with no indication of a diversion, to a more expansive treatment of the question just mentioned, which in turn leads to an argument designed to show that 'the κίνησις is in the patient (not in the agent)' (III 3, 202a13-b22). Immediately after this Aristotle gives formal notice that the section on the definition of change is at an end, winding up with the following words:

'It has been stated what κίνησις is, both in general and as regards its particular species. For it is clear how each of its kinds will be defined. Alteration is the actuality of the alterable insofar as it is alterable. But it is more perspicuous ('γνωριμώτερον') to say that κίνησις is the actuality of the potential agent and patient (τοῦ δυνάμει ποιητικοῦ καὶ παθητικοῦ) insofar as they are potentially so, whether we say this *simpliciter* or in application to particular types of case such as building or healing.' (202b23-28)

So Aristotle concludes the account of κίνησις with what amounts to a reformulation of the original definition in terms of agent and patient.

The potentiality so central to the definition is now explained as the potentiality of agency and patiency. But if change by definition involves a potential agent and patient, then the actuality of change must be the actuality of agency and patiency (since it is only in actual change, caused or suffered, that something is an actual agent or patient). In effect, then, these concluding lines declare that change is by definition the actuality of agency and patiency, these actualities being grounded on their own corresponding potentialities.

(3) What moves him to this reformulation, and how can it be supposed even to make sense as applied to change in general, and in particular to the primary type of change, *viz.* natural change? These questions will engage us in this and the next chapter. But it should be said at the outset that the text of the *Physics* offers hints rather than answers. In particular Aristotle never explains how it is that the very definition of change as such is supposed to involve the agent-patient relationship. In the discussion of Book III the transition is made as if justification were unnecessary. This situation is not remedied by a subsequent argument in VIII 4 purporting to show that everything that changes is changed by something, for Aristotle can only achieve this conclusion by departing radically from the meaning he has assigned to 'agent' and 'changer' in III. In *De Generatione et Corruptione* he devotes several chapters (I 6 - 10) to just such an independent discussion of agency and patiency as we might have expected him to instigate in the *Physics* along with similar discussions of space, time, infinity, etc. But it is noteworthy that in *De Generatione et Corruptione* he never tries to delineate an essential relationship between agent-patient and change as such. He is there concerned only to state what agency involves when it occurs, not to show that it occurs of necessity whenever change does (although no doubt this is taken for granted). These defects of exposition would hardly matter if in the *Physics* the agent-patient concept figured only as an unimportant offshoot from the account of change. But nothing could be further from the truth, since it is this concept that has to bear the whole weight of the massive argument in VIII for a supreme immaterial unmoved mover.

(4) We shall consider that argument in the next chapter. Meanwhile we must examine the general position from which Aristotle is able finally to reach his conclusion in VIII. But a word first about terminology. I am translating Aristotle's pairs 'ποιοῦν'/'πάσχον' (and cognates), and 'κινεῶν'/'κινούμενον' (and cognates) by 'agent'/'patient' (etc.), and 'changer'/'changed' (etc.) respectively. In the present discussion the pairs will be used interchangeably, in accordance with Aristotle's own usage in III 1 - 3. As a rule, he tends to reserve 'πάθος' and its cognates for qualities and changes in respect of quality.¹ If 'πάσχειν' is taken as meaning the same as 'to have a πάθος', then in this narrow sense something πάσχει only if it is a patient with respect to qualitative change. However, when in III 3, 202b26 - 7 Aristotle recasts his definition of κίνησις in terms of 'ποιεῖν' and 'πάσχειν', he is obviously using the latter word to cover all the categories of change covered by 'κίνησις' itself. Now his general position concerning agency and patiency may be summed up in the following propositions:

- (i) Everything that changes (intransitive) is changed by a changer.
- (ii) A changer is a source of change distinct in some way from that which is changed. (For this, see especially *Physics* VIII, 4 - 5.)
- (iii) To act as a changer is not to change (intransitive).

We shall begin by considering (i) and (ii).

(5) Although in III 1 Aristotle speaks as if 'κίνησις' and

1. Bonitz s.v. 'πάθος', 3 (556b - 557a4). For Aristotle's own discussion of the wider and narrower senses of 'ποιεῖν' see *De Gen. et Corr.* I 6, 323a15 - 20.

'μεταβολή' were synonymous, he conducts his analysis almost entirely in terms of 'κίνησις'. Hence it may have seemed a necessary truth that every change that takes place, takes place in a subject that is changed. For the verb 'κινεῖν' can express a meaning equivalent to the intransitive 'X changes' only when used in the passive voice. (It is otherwise with 'μεταβάλλειν', which may be used intransitively in the active, and often is so used by Aristotle, as *e.g.* in Book VI *passim*.) However, his reformulation of the definition of κίνησις in III 3 entails that for every change there is not only a changed, but a changer. It might seem that this too follows from the linguistic rules of usage for 'κινεῖν'. For if change is predicated of the subject of change by means of a verb in the passive, does not the grammatical relation between active and passive ensure that there is a logically equivalent sentence with the same verb used transitively in the active, and the subject of the previous sentence functioning now as grammatical object? This however is not so obviously true. Grammar alone dictates that where the verb of change is 'κινεῖν', the subject of change must be described as a 'changed' ('κινούμενον'). But it is not obvious that grammar alone forces us to accept the corresponding active-voiced sentence, and so to acknowledge a changer. Linguistic rules oblige us to suppose a changed for every changer, but not the reverse. For where 'changes' is transitive, 'X changes -' is grammatically ill-formed, as much so as 'X is with -'. The same is true of 'X is changed by -'. But in using the passive, there is no need to append the preposition that asks to be completed by an agent-term. We can simply say: 'X is changed (κινεῖται)'. This is not grammatically ill-formed. It is a complete sentence, fulfilling the basic requirement of 'saying something about something'.² It may

2. Cf. *De Int.* 5, 17a20 - 21.

indeed be a necessary truth that for every changed there is a changer, but if so, the necessity is not grammatical: it is like that of the sentence: 'For every changed, there are conditions whose presence would have prevented it from being a changed'. The rules of language do not demand that a well-formed sentence make reference to the conditions whose presence would have hindered; nor do they demand reference to an agent, even when the verb is grammatically in the passive.³

(6) 'κλυεῖσθαι' then is passive as to its grammatical form, but not necessarily passive as to its meaning, and I have just argued that the grammatical form does not grammatically require the construction of an equivalent sentence with the verb in the active and an agent-term as subject. But it may be that conceptual if not grammatical considerations justify the inference from 'change' to 'changer'. Every change, after all, is dependent on something, and every change takes place in a subject. Is it legitimate to equate subject with changed, and that on which change depends with changer? The second of these questions is the difficult one. For it seems clear that the subject of change is the changed, *i.e.* the patient - on one proviso. The proviso is that there be an agent or changer. For if there is no agent, then although there may be a change and a subject of change, the subject is not a patient, or a changed, in any but the weak grammatical sense displayed in the linguistic behaviour of the Greek

3. Cf. J. Lyons, *Introduction to Theoretical Linguistics*, p. 378: 'If there is any function that is common to the passive in all the languages that are customarily said to have a passive voice (and in certain languages this seems to be its sole function: *e.g.* in Turkish), this is that it makes possible the construction of "agentless" sentences: *e.g.* Bill was killed.'

verb 'κινεῖν'. But it is safe to say that if there is an agent, then it is the subject of change that is the patient. So the question is whether there is in every case an agent, and, more specifically, whether the fact that every change is causally dependent proves that every change has an agent.

(7) Aristotle is given to speaking of the agent or the changer of a given change. Thus he does not see any and every condition on which a change depends as its agent. There are many such conditions, so that none is as such the condition. 'The agent' makes sense only if used of some factor uniquely related to the change. Given Aristotle's scheme of concepts, the uniquely related factor ought to be identified with that which determines the form or pattern of change. For there are many conditions without which the change could not occur, but what determines the type of change is a single individual embodying a single principle, whether substantial nature or purpose. This conclusion is borne out by Aristotle's words at III 2, 202a9 - 12:

'The changer will in each case confer the form, either of substance or of quality or of quantity, which form will be the principle and cause of the change whenever the changer operates. For instance, an actual man makes what is potentially a man into a man.'

Now this remark is intended to apply to all changes as such, or (given the inbuilt restrictiveness of the definition in III 1) at least to all changes dictated by nature or purpose. But natural change, which is presupposed by all other kinds, typically involves only one individual substance. The man begotten by man in Aristotle's example must also grow. In this case the same individual substance is the subject of growth and also its source, being not merely the locus of change but such as to change in that way. Does this mean

that the substance is agent (and therefore also patient) of its change? An affirmative answer would entail abandoning the second of the three principles set out in paragraph (4) above, *viz.* that there must be some distinction between agent and patient. Where source and subject are the same individual, as in natural change, there appears to be no room for the agent-patient relationship as defined by those three principles. This problem is especially disconcerting given the context in which it occurs. That context is Aristotle's reformulation (as he takes it to be) of the original III 1 definition of change in terms now of agency and patiency. In the last chapter we saw (paragraphs (36) ff.) how the original formula fitted only natural changes and their analogues. Now we find that the new (agent-patient) formulation fits natural change not at all. Both formulations of what is intended to be a definition of change fail to cover the whole field; but worse still, they fail to cover opposite areas.

(8) But to avoid this latest difficulty perhaps we should identify the agent in natural change with the nature itself or principle embodied in the changing substance. In arguing against the Eleatics in I 2, Aristotle remarks that a principle cannot be identical with that of which it is the principle (185a3-5). Since nature is a principle of change, we can infer that a thing's nature is other than any of its changes. Can we also infer, though, that the nature is other than the subject of those changes? And if in some sense this is true, is it a sense of 'other than' that would license saying that the nature is the agent? Our earlier discussion revealed no grounds for saying that the nature is a special kind of thing "inside" a

particular substance. Indeed, if 'thing' is interpreted precisely to mean 'particular substance', Aristotle's concept of nature decisively forbids any such view. If a nature were itself a particular substance, it would not be, as he says in II 1, 192b34, 'in a subject'; hence the subject of change of which a nature is supposed to be a nature would not have that nature "in" it. The subject of change, then, would either be identical with the nature (which in that case cannot stand to the subject as agent to patient) or not; and if not, then since the nature is not "in" the subject either, the subject, it seems, is without a nature, hence without substantial character, hence no substance. A nature, then, is not a distinct thing from the particular individual natured. No doubt we can say that it is an aspect of the individual, distinguishable in thought from other aspects. But is this distinction strong enough to justify regarding the nature as an agent? In cases of externally determined change, Aristotle identifies the agent or changer with the concrete individual substance that is sufficient cause, the begetting parent, the house-builder, etc. It would therefore be risky to suppose that where the change is not externally determined, he assigns the agent-rôle to a "nature", which is only an abstraction. How could the "nature" stand to the subject in a relation sufficiently similar to that which holds between concrete agent and external subject for it not to be sheer confusion to speak of 'agent and patient' in both cases?⁴

4. Cf. A. Mansion, *Introduction à la Physique Aristotélicienne*, pp. 226 and 233, for a strong statement of the view that (on Aristotelian principles), the efficient cause of change is not, strictly speaking, the principle (nature or art) but the concrete substance that embodies it. Mansion does not indicate how this can be reconciled with the notion of 'self-change' introduced in *Physics* VIII.

(9) We shall recur to these questions in the course of the next chapter (paragraphs (8) - (9) and (34) - (36) in particular). We are not obliged to pursue them at present in order to interpret Aristotle's general theory of agency-patiency. For as we shall see, he does not indulge in any general identification of natures with the agents of natural change. Hence the problems of this identification are for the moment a side-issue. What concerns us now is whether he can make good the principle that for every change there is a changer, or whether he can make it good without giving up some other principle or assumption. For instance, if changer and changed need not be distinct, natural change would present no problem; the same concrete individual would function as both. Or if the changer need not be the determinant of change, but only something on which change depends, natural change could be put down to an external concrete agent (or set of agents). In the end it is this last assumption, that the agent determines the form of change, that Aristotle drops so as to save principles (i) and (ii). This takes place in *Physics* VIII 4.

(10) The context is an argument designed to demonstrate that whatever changes is changed by something. (It is assumed that what something is changed by is its changer.) The reasoning has an ambiguous flavour; it betrays on the one hand an *a priori* resolve to save at all costs the conclusion to be proved, while on the other hand proceeds as if this conclusion were no longer self-evident or true by virtue of the very definition of 'κίνησις'. The argument parades as empirical; it is an induction from cases, but with a foregone conclusion. The types of change are divided into enforced and natural, and natural change is subdivided into organic and inorganic. Aristotle

then argues that in each division, change is a change by something. Enforced change presents no problem; obviously it is by something, *viz.* an external physical substance. Nor does Aristotle find any difficulty in supposing an agent for the natural changes of living things. These are changed "by themselves", and although the meaning of this is not fully explained, he takes it as intuitively certain that a living thing (and especially an animal) contains an agent of its natural changes which differs from the subject of change in a way which may, as he says, be difficult to analyse, but which clearly permits us to regard the subject as a genuine "changed".

'The proposition that whatever changes (*κινεῖται*) is changed by something is most obviously true in the case of things changed against their nature, since it is apparent that they are changed by something else. The next most obvious cases after these are things that change by their nature but are changed by themselves, such as animals. For what is difficult to make out is not that they are changed by something, but in what way the changer in them is to be distinguished from the changed.' (VIII 4, 254b24 - 30)

The whole question of "self-change" in *Physics* VIII will be a major topic of the next chapter, but meanwhile let us see how Aristotle deals here with the remaining class of cases, the natural changes of the simple inanimate bodies. These present the worst problem ('*μάλιστα δ' ἀπορεῖται*', 255b33) for anyone who maintains that whatever changes is changed by something. For here there is no external determinant of change, yet Aristotle refuses to class the simple bodies along with substances that are changed "by themselves". Self-changers, he says, are alive, they naturally change in diverse ways, they are physically complex (255a5 - 18). This is enough to show that the mere fact that a substance has a nature is not for him a sufficient ground for holding that it has "within" itself an agent. For the simple bodies no less than organic creatures have natures that are sources

of change. If every nature as such were an agent of natural change, then all natural change would be "self-change" in substances of every type.

(11) So what are the "changers" responsible for the natural changes of the simple bodies? Aristotle can solve the problem only by a conceptual shift: *i.e.* by breaking with the original meaning of 'changer' laid down in III 2. The natural changes of the simple bodies are not, he argues, totally independent of everything else: in the first place, a mass of earth or fire owes its natural motion to the agent that generated it and made it be what it is, fire or earth; and secondly, the realisation of the motion depends on the absence of external interference, so that whatever removes an obstruction is also responsible for the change. In these changes then, he concludes, the subject is changed, not by itself, but by something, whether the generator or the remover of hindrances (255b35 - 256a2). But neither of these changers can possibly be said currently to determine the motion while it is happening. The generator (according to his theory of elemental transformation) no longer exists,⁵ and the remover of hindrances not only does not determine the form of the change, but might rather be said to gain its character as remover of hindrance from the very change of which it is supposed to be the agent. For what constitutes a hindrance, and what (therefore) the removal of one, depends on the direction of the tendency pre-existing in the simple body.

5. As Simplicius puts it (*Comm. in Phys. ad* 255b31 - 256a3, Diels, p. 1220, 9 - 11): 'εἰ τὸ γεννησάν καὶ ποιῆσαν πῦρ πέπαυται ἐνύστε καὶ οὔτε πάρεστιν οὔτε ἐφάπτεται τοῦ κινουμένου, πῶς ὑπ' ἐκείνου λέγεται κινεῖσθαι τὸ πῦρ;'

(12) It is perhaps no accident that during this argument Aristotle speaks only of that by (ὑπό) which the simple body is changed and not of its changer (κλινούν). For the latter expression unavoidably suggests a currently acting determinant, whereas the former permits the interpretation that the change itself (the natural motion) is an intransitive event brought about by the earlier action of an agent. On this interpretation, the body is only a patient with respect to the earlier action, say of releasing: this it "suffers", but not the change that thereby becomes open to it. However, Aristotle decisively blocks this interpretation when he writes in 255b29 - 31:

'It is clear that none of these [the simple bodies] changes (transitive) itself. But each has a principle of change, not of (transitively) changing something (τοῦ κλινεῖν), nor of making something come about (τοῦ ποιεῖν), but of suffering (τοῦ πάσχειν).'

Since the principle investing the simple body is a principle of change (not a principle for being released by some external agent), Aristotle must mean that the change itself is a "suffering". But he cannot mean to assert this merely on the ground that the change owes its being to the prior action of an external agent. For by that criterion many things would count as "sufferings" which for him are conceptually opposed to suffering. For instance, where the activity of an agent results from the agent's release from constraint, this would be "suffering". (Even the activity of the changer within the "self-changer" might turn out to be a "suffering", at this rate.) In 4 255b3 - 11 and 20 - 23 Aristotle carefully compares the natural motions of the simple bodies when released with the knower's exercise of knowledge, which is supposed to take place whenever nothing prevents it. Yet the exercise of knowledge is an ἐνέργεια in the special sense in which Aristotle contrasts this terms with 'κίνησις' (v.i. paragraphs (27) ff.). It is like thinking, seeing and being happy, all of which

occur 'unless prevented' (given the appropriate state of the subject); but these are the very last conditions that Aristotle would connect with "suffering". Not only is this term's suggestion of subjection to the undesirable wholly inappropriate in their case, but so is its broader and more neutral meaning of 'condition that does not come from the subject itself'. For these activities are the highest expressions of the natures of beings capable of them. It is clear then that Aristotle's only reason for classing the principle within a simple body as a principle of suffering, is that it is a principle of change; the reason is not that it owes its manifestation to a releaser. In other words, he is simply identifying change as such with suffering for no apparent reason other than that change is change. For seeing and the exercise of knowledge are not sufferings because, as we shall see, they are not changes (κίνησις) but ἐνεργεία. (The difference between these categories turns on the difference between the complete and the incomplete. An ἐνέργεια is essentially complete as long as it lasts, a κίνησις essentially incomplete.)

(13) We shall presently investigate this last-mentioned distinction in some detail; meanwhile let us summarise the position to have emerged so far. (a) Aristotle's doctrine of nature makes it impossible for him to hold that every change has a changer in the sense of a concrete agent (other than the subject) that determines the shape of the change. (b) It remains to be seen whether in some cases the nature of a substance might not fulfil the rôle of "changer". However (c) it is clear that in some cases (the natural changes of the simple bodies) the nature is not seen by Aristotle as an inner agent. (d) Since in these cases there is no external concrete substance shaping the change either, Aristotle can only preserve the principle that for every change

there is a distinct agent by diluting the concept of agent so that it no longer implies 'currently acting determinant'. Thus (e) even the generator and the releaser are now "agents", and the change is considered to be a "suffering" in relation to them. On the other hand (f), it is not because of what these so-called "agents" do (*i.e.* generate and release) that the subject is said to "suffer", but because of what happens as a result, *viz.* a change. In effect, Aristotle cannot or will not recognise such a thing as intransitive change that is neither an acting upon nor a being acted upon. His assumption appears to be that since the nature manifested in *e.g.* the typical movement of fire is obviously not a principle for acting upon other things (save *per accidens*), it must be a principle for being acted upon or suffering. He admits no third possibility. But it cannot simply be the event's dependence on the action of prior agents that justifies equating it with suffering. For states of natural rest (the fire's at last being where it belongs) are likewise dependent, as are various non-kinetic activities. Perhaps it is the incompleteness of change that provokes this classification of it as essentially passive. But Aristotle does not bring into the open the conceptual connection between passivity and incompleteness, and it remains thoroughly mysterious.⁶

(14) So far then we have failed to uncover any sound basis for

6. Simplicius tries to explain as follows (*ibid.* lines 21 ff.):
 'Θαυμαστῶς ἤυρεν καὶ ἐν τοῖς κατὰ φύσιν κινουμένοις τὸ ὑπὸ τίνος κινεῖσθαι τὸ κινούμενον, ἐπειδὴ τὸ κινεῖσθαι πάσχειν τί ἐστι, τὸ δὲ πάσχειν δεῖται τοῦ ποιοῦντος. ἡ μὲν γὰρ τελεία ἐνέργεια ἐκ τῆς τελείας οὐσίας προΐοῦσα οὐ δεῖται τίνος ἄλλης τῆς παραγωγῆς αἰτίας, ἡ δὲ κίνησις ἄτελης οὖσα ἐνέργεια καὶ πάθος μᾶλλον καὶ πολλῷ τῷ δυνάμει συγκεκραμένη δεῖται τοῦ ποιοῦντος αὐτὴν.'

Aristotle's assumption that change is essentially dependent on an agent. However, there is one aspect of the original definition of κίνησις in III 1 which we have not yet considered at all and which might serve to bridge the gap between this and the reformulated version at the end of III 3. The original version has a defect, noted with unease by the ancient commentators,⁷ which it might seem can only be remedied by reference to the concept of agent-patient. If κίνησις is defined simply in terms of the subject's potentiality to be in a state that it is not actually in, then it follows that the concept of κίνησις is co-extensive with that of potentiality: to every potential condition, there corresponds a possible change defined as the actuality that holds of the subject insofar as it is potentially in that condition. But there would appear to be at least one class of potentialities to which there do not correspond changes or κινήσεις. These are comprised under the category of Relatives. There seems to be no good reason for refusing to extend the 'actually/potentially' distinction to this category. Thus it should make sense to speak of X as potentially smaller than Y, etc. Suppose now that it comes to be true of X that X is actually smaller than Y. According to the definition, this transition from the mere potentiality to the actuality ought to count as a change on the same logical level as that of bricks becoming a house or a boy growing to full height. But intuitively we reject the idea that 'coming to be smaller than Y' describes a change in X. For, as we say, it could be true of X even though X has not changed, but only Y. Aristotle endorses this common-sense reaction when he excludes relatives from the list of categories

7. *Ad Phys.*, 202a3-7; Themistius, Schenkl, p. 75, 3 ff.; Philoponus, Vitelli, p. 367, 8 ff.; Simplicius, Diels, p. 436, 26 ff.

in respect of which κίνησις is possible (V 2, 225b11-13).⁸ Yet this is not justified by his own original definition of κίνησις. The conceptual elements of that definition, *viz.* potentiality and actuality, occur in all the categories including that of Relatives. So if Aristotle's manipulation of these elements can succeed in producing a formula that covers, say, qualitative change, how can it fail to cover, at the same time, "changes" in all the categories?

(15) Our unwillingness to count the acquisition and loss of relational properties as "real" changes may have no single simple reason.⁹ But perhaps the most obvious difference between these and "real" changes arises over the spatial relationship of cause to effect. If X grows ("really" changes size), thereby becoming taller than Y, then Y becomes shorter than X. Now the only cause of this new relational property is whatever it is that causes the growth of X. It is because X grows that its size changes in relation to Y's and Y's

8. It is clear that here Aristotle excludes the acquisition of new relational properties from the class of μεταβολάαι as well as from the class of κινήσεις, which in this context are regarded as a sub-class of μεταβολάαι.

9. For a contemporary statement of the problem, see P.T. Geach, *God and the Soul*, pp. 71-72: 'The only sharp criterion for a thing's having changed is what we may call the Cambridge criterion (since it keeps occurring in Cambridge philosophers of the great days, like Russell and McTaggart): The thing called 'x' has changed if we have 'F(x) at time t' true and 'F(x) at time t₁' false, for some interpretation of 'F', 't', and 't₁'. But this account is intuitively quite unsatisfactory. By this account, Socrates would after all change by coming to be shorter than Theaetetus ...'. (Along with Russell and McTaggart, Geach could have included G.H. von Wright, *Norm and Action*, ch. II, on 'The Logic of Change'.) On p. 99 *ibid.* Geach continues: 'These, we should wish to say, are not real changes in Socrates. But I do not know of any criterion, let alone a sharp one, that will tell us when we have a real change in Socrates, and not just a 'Cambridge' change. The search for such a criterion strikes me as an urgent task of philosophy.'

to its. Thus whatever cause results in X's growth results also in Y's acquisition of a new relative size. But there is a striking difference between the relation of this cause to X, and its relation to Y. Let us call the total cause of X's growth 'C'. Now C is a set of conditions in and around X. For the various component-conditions of C to produce the effect in question, it is not enough that they should simply exist; they must exist in or in the environment of X. If they were cancelled from there but reproduced somewhere else, they might as well not exist at all for all they would do to assist the growth of X. But it is quite otherwise with the causal relation of C to its other "effect", namely the transition from one to another relative property in Y. Y becomes (by the same amount) smaller than X wherever Y may be; however far removed from X, and however far removed, therefore, from C which caused the growth of X. But C is also and thereby the cause of this "change" in Y. Yet this "effect" of C in no way depends on or varies with the particular spatial relationship between its subject Y and its cause C. Provided that C does result in the growth of X, it is enough that C should occur merely in the same universe as Y for it to be true that C "makes" Y shorter than X. This surely is one reason why we put the inverted commas round "makes", and "change", and "effect". If we counted these shifts in relational properties as real changes or real effects, we should be attributing to the cause C a power of absolute scope and absolute immediacy. For its "effect" would be in no way diminished by the distance of the object "affected"; nor would it vary in any way on account of changes in the contents of the space separating C from that object. It is because we refuse to recognise this "effect" as a real change at all that we need not recognise a "power" to produce it.

(16) The subject of a "real" change of a given sort must not only be capable of changing in that way, but it must also stand in a particular relationship to a cause sufficient for producing that change. And that the subject stands in this relation does not follow from its being of a kind capable of the change. Thus if a particular cause produces a change in a given subject, there is no reason to suppose that it also produces a similar change in other potential subjects. On the contrary, if the cause is identified with a spatial object or spatial condition that stands to the subject of change in a given spatial relationship, it is clear that there could be in existence other suitable subjects that would be debarred by the very logic of space itself from an appropriate spatial relation to that particular cause. For the same particular cause C cannot be in contact with, or at a given distance from, every suitable subject at the same time, unless it so happens that there are in existence only as many suitable subjects as there is room for near or around or at the appropriate distance from the particular cause C. And if this were the case, it would be a purely contingent fact. Thus in general, a cause of a "real" change selects, by its situation, only some among all possible subjects to be the actual subjects of its effect on any one occasion. By contrast, the particular cause of a "change" in some relational property causes at one and the same time comparable "changes" in all possible subjects that exist. If Y "becomes" smaller than X, because of C, then every other object commensurable with X and Y *ipso facto* "undergoes" a corresponding "change" by the mere fact of being a member of the class of objects thus commensurable. We may say then that what distinguishes a "real" change from a relational one is that the former owes its existence to a particular cause that does not necessarily produce a similar effect in every object of the same kind. Now although

we have argued this point by reference only to physical causes that occupy space, we may extend it to cover also incorporeal causes, such as *e.g.* souls. For although the reasons for or against regarding these as causes have not yet been considered, we should at least make room for them in an account of Aristotle's notion of agency. Now the incorporeal causes recognised by Aristotle (*v.i.* Chapter V, paragraph (10)) are as selective in their operation as corporeal ones. A particular soul, for instance, controls not every body of a given sort, but one: nor could it control any other. Even the supreme incorporeal mover, which is not (at any rate in the *Physics*) explicitly identified with a soul, immediately affects one body only, the outermost sphere of the universe.

(17) We may conclude, then, that the very concept of change makes essential reference to the concept of a particular cause of change that stands in a special relation to the subject. For without this reference, no distinction can be upheld between "real" and relational change. If we could allow ourselves to identify this notion of a cause that stands in a special relation to the subject with Aristotle's notion of agent or changer, it would follow that his reformulation of the original definition of κίνησις in terms of agent and patient is entirely justified. It is true that so far as corporeal agents are concerned, Aristotle restricts the range of the "special relationship" more narrowly than facts now known may warrant, since he holds that it must consist in contact between the two bodies. In speaking vaguely as we did above (paragraph (15)) of the cause C as 'in or around' the subject of the real change, we deliberately left this question open. It is perhaps an empirical matter whether or not

contact is necessary. The point of conceptual importance is that the subject should be within a given range of the cause. What the range is will vary with the circumstances, with the particular characteristics of cause and subject, and with the type of change in question. All that matters for our argument is that 'within range of C' cannot be interpreted so widely as to cover any object where-soever located. In the same way we may extend the specification of the "special relationship" which Aristotle employs when describing the case of an incorporeal agent causing change in a physical object. He says of the former that it touches without in turn being touched (*De Gen. et Corr.* I 6, 323a25 - 34). Commentators have usually dwelt on the negative aspect of this curious extension of the concept of touching, *i.e.* on the implication that the agent is not and cannot be affected in turn by the patient. But that the agent touches is no less significant than that it is not touched, for this makes the point that the agent stands to the patient in a relation in which it (numerically the same agent) does not stand to any and every possible patient. The agency of the agent presupposes that the agent has an *ubi*, although it has, in this case, no *locus*. Thus the metaphor of 'touching without being touched' is appropriate insofar as it attributes position to the agent even though incorporeal. It is inappropriate so far as it suggests that the literal fact from which the metaphor is taken must always involve the over-restrictive condition of contact. We can remedy this by rephrasing the metaphor as follows: the incorporeal agent 'reaches to the patient but without the patient's in turn reaching to it'.

(18) If the argument of the last four paragraphs is acceptable, does it succeed in upholding Aristotle's apparently illegitimate slide from the concept of change as such to the concept of change brought about by an agent in a patient? It certainly illuminates this slide, but would fully justify it only if 'agency' in Aristotle's scheme of concepts had no other function than to mark the logical difference between properties in respect of which real change is possible, and relational properties acquired and lost without real change. We have argued that the need for a specially related cause is what differentiates "real" changes. But this conclusion is only a special case of a wider conclusion that can be reached by the same argument. For the having of a "real" property, no less than the acquiring it by a "real" change, differs in just this way from the having of a relational one. If X grows (or is made to swell) to a certain size, then its remaining at this size depends upon what happens where it is, and similarly with qualitative states. But Y's remaining shorter than X depends in part on a situation which may be as far removed as we please from Y itself, namely the environmental situation of the other term of the relation, X. If by 'agent' we were to mean no more than 'cause (or causal condition) whose causality depends on its special situation *vis à vis* the subject', then it is not just change that requires an 'agent'. But it is evident that for Aristotle 'agent' has a narrower meaning which relates especially to change. He would insist that some non-relational non-change conditions require an agent: *e.g.* conditions of contra-natural rest in natural substances. But there is no sign of his supposing that in general rest depends on agency. By contrast, he holds that all changes are "sufferings" and as such are agent-dependent. No doubt one motive for this insistence is the need for a universal premiss from which to

argue that the ultimate physical change of the universe depends on something other than the mere changing body itself (*v.i.* Chapter V). This aside, his grounds for maintaining a necessary connection between change in particular, and agency, remain obscure. And in view of his willingness to alter the meaning of 'agent' in order to be able to locate an agent for every change (*cf.* paragraph (11) above), we cannot but wonder whether there is any single interpretation of this concept by which he would be prepared to abide.

(19) But although we have not succeeded in pinning him down to a precise meaning of the terms 'agent' and 'changer', there are some instances of change to which it would seem reasonable to apply the notion of 'agency/patiency' if to any at all. I refer to those cases in which one individual physical substance brings about a change in another. Let us now leave the question whether all changes have agents, and concentrate on those which most obviously do. If we can make out the conceptual features of these paradigm cases, it may be possible to decide whether the more dubious ones resemble them sufficiently to be brought under the same schema. How otherwise, for instance, can we evaluate the curious notion, propounded in Book VIII, of a "self-changer", a single substance that somehow comprises within itself both agent and patient? Unless the alleged "inner" changer and changed within the self-changer can be shown to bear some analogy to changer and changed in clear-cut external cases, 'self-changer' is only a metaphor, and provides no sound basis for philosophical argument. Moreover we have still to elucidate the third of the propositions listed in paragraph (4) above, namely that a changer as such does not (intransitively) change, according to Aristotle. If this

cannot be shown to make sense in the obvious cases, there is little hope of defending it in connection with dubious and marginal ones.

(20) But since we are not criticising Aristotle only on his own terms, let us begin by asking what from a philosophical point of view is ever gained by speaking of agency and patiency, even in those cases where this phraseology seems most obviously to apply. To say that one thing acts upon another, or does something to it, or makes something happen in it, seems to suggest that there is a concrete and particular process of causing, as concrete and particular as the change itself that is caused, and as the substances concerned in the change. Yet Hume's theory of causation, whatever its defects, has at least, one might suppose, succeeded in correcting any tendency to believe in "causing" as some kind of particular process. Such a thing is empirically unidentifiable, and the idea of it fails to explain either the events themselves or our knowledge of them. Indeed "making", "acting upon", etc., appear to represent nothing more than the projection on to nature of mere forms of language. These forms are the transitive verbs, active and passive, by which we so often describe causal relations. These verbs are tensed, and they connect grammatical subjects and objects which denote actual concrete particulars (called the 'agent' and 'patient'). As a result, it might be argued, it is easy to imagine that these verbs denote certain particular connecting relationships that exist at particular times and places, just as the objects connected do. But even critics of Hume are almost unanimously agreed that he has rightly taught us to think of causation as a relation between objects and events considered not in their particularity but as members of classes of resembling ones. Where there is

disagreement, both with Hume himself, and of the critics with one another, it concerns the precise specification and grounds for asserting this general relation. But it is assumed on all sides that the general relation (which for our purposes it is sufficient simply to denominate as 'law-like', however this be interpreted) cannot itself be regarded as a particular. Neither (a) the connection between antecedent and consequent of a law-like generalisation, nor (b) the "falling-under" relation in which particular objects and events stand to that antecedent and consequent, is itself a particular fact pertaining to a particular region of space-time. These relations hold, if not timelessly and spacelessly, at any rate everywhere and always. Thus the transitive verb can, on this view, be eliminated in favour of a universal hypothetical covering particular objects or events whose changes are describable intransitively. The singular sentence 'X heated Y' is translated as: 'X was a member of the class ϕ , and Y of the class ψ , and whenever under certain conditions (supposed to have obtained on the occasion in question) a ϕ is within a given range of a ψ , the ψ becomes hot.' In this formula, the clauses following 'whenever' do not denote a particular fact or facts. Thus, if this analysis is correct, it shows that the apparent "this-ness" of what is referred to by 'heated' in 'X heated Y' is only apparent: it is nothing but a reflection of the particularity of the terms of the relation, X and Y, not of the relation itself.

(21) If all transitive causal verbs are indeed reducible in the way just outlined, it follows that the philosopher would do well to discard them altogether from his reflective vocabulary, so as to be rid of a standing source of temptation to read into real events and

changes mysterious connectings: a notion that may possibly satisfy some psychological need, but lacks all cognitive meaning. Now there can be no question here of entering fully into this issue. But raising it serves to frame two results of the discussion on which we are about to embark. These are (i) that for Aristotle, no less than for Hume, 'agency' and 'acting upon' are not to be understood as referring to any kind of extra non-empirical process beyond or behind the phenomena; but (ii) that for Aristotle by contrast with Hume, these expressions, far from being eliminable from the cognitive vocabulary, perform a cognitive function that could not be adequately catered for by formulae in which the particular terms of particular causal relations are connected only by a covering law-like generalisation.

(22) The Aristotelian passage that first concerns us is III 3, 202a13 - 202b22. Aristotle's problem here is different from the one which we have just raised in response to the Humean theory, but his discussion contains the elements of an answer to the latter. His question (apparently a familiar one¹⁰) is: Is the change (κίνησις) in the patient, or in the patient and in the agent? And his answer is: In the patient.¹¹ The problem arises because Aristotle must tailor his concept of agency and patiency to accommodate the notion of a first changer in every causal series of changes. There must be a first changer, because there must be an originating determinant of change. But if there is an originating of change, then it cannot be

10. Cf. W.D. Ross, *Aristotle's Physics*, p. 540.

11. Cf. *Metaph.* Θ 8, 1050a28 - b1.

the case that the substance which originates itself changes (intransitive) in so doing. For then either we have a change without a changer; or there is a changer other than the originating substance (which would contradict its being an originator); or the originator itself causes the change in which its originating consists: but then this causing too would consist in a change (intransitive) in the originator, so that another causing is required, and so on, and there will thus be no originating by the originator, since every act of originating would require an infinite number of similar acts by the same agent. Therefore the causing of change by the originator (whether the latter be the cause of the heavens' motion or a sublunary natural substance operating according to its own nature) must not be or involve any change in which the originator changes (intransitive). So whatever causing a change may be, it is not for Aristotle, any more than for Hume, an extra process of change.

(23) Although Aristotle will use this conclusion in connection with the problematic "self-change" of organisms, in which one "part" is supposed to be changer of another, he argues for it in general, and takes as his only illustration the case of teaching and learning, where the agent and patient are clearly different individual substances. His argument proceeds on the following assumption: the only reason anyone could have for supposing that being a changer (an actual changer) entails change in that changer, rests on a false view of the difference between causing and suffering change. It is only through regarding these (in some given instance, such as teaching and learning) as different concrete events, that one could be misled into thinking that the changer undergoes a change. But once it is seen

that these are different ways of describing the same event, the problem disappears, leaving only one change, which is to be located in the patient. This is the outline of Aristotle's argument, and its drift may be roughly clear, but some detailed comment is necessary.

(24) The problem as Aristotle presents it in III 3 is shaped by two assumptions. The first (i) relates to the meaning of 'change' or 'κίνησις'. Aristotle is here using 'κίνησις' as the generic term for any process corresponding to a verbal noun with the typical '-σις' ending. By this criterion, not only are comings-to-be-in-a-new-state (represented by such nouns as 'γήρασις', 'μάθησις') changes, but so are transitive activities such as those represented by 'οἰκοδόμησις', 'δίδαξις', 'ἰάτρεισις', etc. This double use of 'κίνησις' is reflected in the passage already quoted from VIII 4 where he says that the simple bodies each contain a principle of change, 'not of causing change (τοῦ κινεῖν) nor of making it happen (τοῦ ποιεῖν), but of suffering it (τοῦ πάσχειν)' (255b30 - 31). This shows that he regards 'principle of change' as interpretable as 'principle of causing change'. However, this usage is not the common one of the *Physics*. As a rule, Aristotle uses 'κίνησις' to mean a process of coming to be in some new state (see especially Books V and VI). The second assumption (ii) is that for every change, something changes (κινεῖται), *i.e.* comes to be in a new state. Now these assumptions taken together seem to yield the following: teaching (δίδαξις), no less than learning (μάθησις) is a change, (by (i)). Thus teaching no less than learning involves the coming to be of a new state (by (ii)). Thus the teacher, who is the subject of the verb 'teaches', must be the subject of the coming to be. Hence the teacher (the agent) is

as much a subject of change (in the more usual sense) as is the pupil in whom the teacher brings about a change. (So being the agent of a change necessarily involves a change in the agent. Thus, given that for every change there is an agent, every change would entail an infinite regress of logically prior changes.)

(25) But this argument is valid only on the assumption that X's teaching is a distinct concrete event from Y's learning. If this were the case, then indeed, since teaching is a change, by (i) above, and since by (ii) for every change there is a coming to be, it would follow that the teacher, being the only substance involved in the distinct event of teaching, would be the subject of this coming to be, since no other subject would be available within that distinct event. But the point of crucial importance which Aristotle emphasises again and again in this passage, is that X's teaching is not a different concrete event from Y's learning. These are one and the same actuality under two descriptions. In effect Aristotle's reply consists in refining presupposition (ii) so as to read: for every concrete change-event there is a coming to be. Now no one denies that Y's learning involves a coming to be of which Y is the subject. But if Y's learning is the same actual event as X's teaching, there is no need to look for another coming to be that corresponds to that teaching: it has already been specified as Y's learning. And this coming to be is in Y; so that it already has a subject, and there is therefore no need to pin it on to X as if it would otherwise float about without any subject at all. This would be necessary only if X's teaching were a self-contained actuality that was, as he says, 'cut off' ('ἀποτετμημένη', 202b8) from Y; but then it would not be teaching

since no one would be taught. Nor is there any paradox in saying that the teaching and the learning (since they are the same concrete event, and the learning is a coming to be in Y) are both in Y. Some dialecticians¹² may try to twist this into absurdity by saying that it would entail Y's learning and also teaching the very same thing. But they achieve the appearance of paradox only by ignoring the different "directionality" of the two descriptions. The same road runs from Thebes to Athens and from Athens to Thebes, but it does not follow that a man travelling this road is at one time travelling to Thebes and to Athens. If 'Athens' enters into the description of his journey as the name of his destination, then 'Thebes' must enter into the description in the opposite sense, as naming his *terminus a quo*. Thus if another man is travelling on the same road to Thebes, 'Athens' must enter into the description of his journey in the sense opposite to that in which it enters into that of the first man. Similarly, if Y is learning and X is teaching, 'teaching' applies to Y only in the opposite sense from that in which it applies to X; thus while X is teaching, Y is being taught. If we think of 'teaching' ('διδάσκειν') as a neutral verb-stem determinable by active and passive voices, then we may say (a) that teaching is to be located in Y as well as in X; and (b) that teaching appears in Y in a determinate form (the passive) that is perfectly compatible with the predication 'Y learns'.

(26) It is to be remarked that in this argument Aristotle dispenses altogether with any discussion of the meaning of transitive verbs of agency, or any comparison of that meaning with verbs of becoming. What

12. The Eleatics, apparently. Cf. Simplicius, Diels, p. 440, 23-24.

matters here is what we should call the distinction between sense and reference: it is enough to show that 'X teaches' and 'Y learns' have the same concrete referent, and any difference in logical structure between these two "senses" is unimportant. This impression is reinforced by the Thebes - Athens illustration, for this is a case in which the two descriptions, 'the road from Thebes to Athens' and 'the road from Athens to Thebes', have senses of identical logical structure apart from the direction of the relation. Similarly with 'teaching' and 'learning' for all that we could gather from III 3. And this suggests that III 3 is not on its own adequate to ensure Aristotle's desired conclusion that being an agent is not to be the subject of a becoming. What III 3 shows is that there is no extra becoming, true of the agent, beyond the becoming which the agent brings about in the patient. It shows therefore, that if we have reason to locate the one and only becoming in the patient, then we are left without any further becoming to locate in the agent. But the argument does not explain why the becoming should be associated only with the patient. In arguing that there are not two distinct becomings corresponding to 'X teaches' and 'Y learns', Aristotle has not shown that these are not descriptions of a single becoming which belongs equally to X and Y. But if this were so it would be as true of X that it is a subject of becoming as it would be of Y.

(27) Thus to complete his proof Aristotle needs to be able to show that transitive agency is not as such a becoming. He offers no argument for this, but an argument can be constructed on his behalf which not only accords with his general position but bases itself specifically on the Aristotelian concept of the incompleteness of κίνησις.

This notion has already come to the fore at the end of III 1, where he asserts that κίνησις is an incomplete (or imperfect) actuality. It is further developed in *Metaphysics* Θ 6, where he draws a distinction between κίνησις and what he calls 'ἐνέργεια', in terms of completeness and incompleteness. I shall now argue that his method of drawing that distinction can be applied in such a way as to show that the transitive causal activity of an agent is not incomplete in the way in which the change effected in the patient is. If this "incompleteness" is to be regarded as built into the notion of change, it follows that an agent's transitive activity is not only not an extra change (or coming to be) but not a change at all.

(28) Aristotle normally uses 'ἐνέργεια' to mean 'actuality', and in that sense a κίνησις, when actual, is an ἐνέργεια. But in *Metaphysics* Θ 6, 1048b18-35, he marks off a narrower sense of the latter term in which it is contrasted with the former.¹³ He opposes the two categories by reference to the concepts of 'τέλος' (meaning both 'end' and 'complete condition') and 'πέρας' (limit). A κίνησις has a built-in limit, and the end or complete condition associated with the κίνησις occurs only when the limit has been reached. A κίνησις continues only so long as the limit has not been reached, and therefore while it continues, its τέλος has not been achieved, and so it is (while it exists) 'ἀτελής' and 'οὐ τελεῖα'. An ἐνέργεια in the narrow sense has, by

13. For contemporary discussions of the distinction see J.L. Ackrill, 'Aristotle's Distinction between ENERGEIA and KINESIS', *New Essays on Plato and Aristotle*, ed. Bambrough, pp. 121 ff.; T.C. Potts and C.C.W. Taylor, 'States, Activities and Performances' (symposium), *Proc. Arist. Soc. Supp.* XXXIX, 1965, pp. 65 ff.; L.A. Kosman, 'Aristotle's Definition of Motion', *Phronesis* XIV, 1969, pp. 40 ff.; T. Penner, 'Verbs and the Identity of Actions', *Ryle*, edd. Wood and Pitcher, pp. 393 ff.

contrast, no built-in limit; its end or complete condition exists already in it, at any moment of its duration. Now at first sight it may seem that this distinction is not going to show any logical difference between transitive agency and the corresponding change in the patient, since in *Metaphysics* H 6 Aristotle illustrates the concept of κίνησις by reference to both kinds of process indifferently. Thus 'making thin' and 'building' are offered as examples along with 'learning' and 'becoming'. This shows, I suggest, that Aristotle is not here fully aware of the power of his own distinction. But this will become evident only when we have examined the way in which he spells out the difference indicated above between κίνησις and ἐνέργεια. He does this by asserting and denying certain conceptual relationships between 'X φs' and 'X has φed', where the values of 'φ' are verbs corresponding to the two categories.

'Thus for instance at the same time one sees and has seen, thinks and has thought, understands and has understood [all examples of ἐνέργεια]. But it is not the case that one learns and has learnt, is [being] restored to health and has been restored. At the same time one lives well and has lived well, is happy and has been happy. Otherwise it would be necessary at some point to stop, as when one makes something thin. But as it is, this is not the case: one lives and has lived. So we should call the one class 'κινήσεις', the other 'ἐνέργειαι'. For every κίνησις is incomplete (ἀτελής): making thin, learning, walking, building. These are κινήσεις, and certainly they are incomplete. For it is not the case that at the same time one walks and has walked, or builds and has built, or becomes and has become, or changes and has changed (κινεῖται καὶ κικίνηται). If these happen at the same time the subject is different. But the same subject at the same time has seen and sees, thinks and has thought. I call the latter kind 'ἐνέργεια', the former 'κίνησις'.'

(29) Here, then, Aristotle is saying that when 'φing' designates an ἐνέργεια, 'X φs' is compatible with 'X has φed', while where it

designates a κίνησις, the sentences are not compatible.¹⁴ This point depends on a rather special sense of 'has φed', in which it means neither (a) that the φing is over, nor (b) that there has been some φing. For if (a) were meant, 'X φs' would in all cases be incompatible with 'X has (just) φed'; while if (b) were meant, 'X φs' would be compatible with, since it would entail, 'X has φed' even where φing is a κίνησις. Or at any rate so Aristotle would hold, according to his doctrine of 'no first moment of κίνησις', (*Physics* VI 5, 236a7-36). Thus in the passage just quoted, 'X has φed' must mean something like: 'X has completely φed' or 'X has performed a complete act of φing'.¹⁵ This sense fits well the condition for κινήσεις, namely that in their case 'φs' is incompatible with 'has φed'. But it requires an effort of interpretation to fit it to the condition for ἐνεργείαι, since it is by no means clear what, in ordinary speech, could be meant by e.g. "'X sees" is compatible with "X has completely seen"', or "'X thinks" is compatible with "X has completely thought"'. However, it is obvious that Aristotle means that if X continues to think or to see, this does not entail that its previous thinking and seeing were incomplete. A κίνησις can continue only for as long as it has not reached its inherent limit, hence it can continue only so long as it is in this sense incomplete. Since ἐνεργείαι have no inherent limit, they cannot in this sense be at any point incomplete: and Aristotle chooses to say that they are therefore at every moment complete. We might prefer to say that they are neither complete nor incomplete,

14. But see note 19 below.

15. Potts, *op. cit.*, p. 68, adduces Chomsky's transformational proof that the perfect in English is not a past tense. Potts argues that in *Metaph.* θ 6 Aristotle uses 'φs' and 'has φed' not as present and past tenses, but as progressive and perfective. (Cf. Potts, p. 76.)

not being completable by attainment of an inherent limit. Thus, in the sense of the perfect tense that implies completeness, we might prefer to say that when ϕ ing is an ἐνέργεια, 'X has ϕ ed' is neither true nor false. We should then have to re-phrase his distinction between κίνησις and ἐνέργεια as follows: In the case of the former, 'X ϕ s' entails that X's previous ϕ ing was incomplete; while for the latter, 'X ϕ s' does not entail that X's previous ϕ ing was incomplete (since it was neither complete nor incomplete). The reason why Aristotle prefers to say (by means of the special use of the perfect tense) that the present continuance of an ἐνέργεια is compatible with its earlier completeness, is that he wants to stress that ἐνεργείαι (or at any rate those which he lists) are ends in themselves, while κινήσεις are not. For in fact the notion of completeness embodied in the special use of the perfect shares all the ambiguity of 'τέλος', 'τελεῖος', etc. A κίνησις is ἀτελής, both in the sense that so long as it continues it is incomplete (being incompletable) and in the sense of not being an end in itself. Aristotle's ἐνεργείαι are τελείαι in the sense of being ends in themselves, so that even as they continue, the ends (*i.e.* themselves) for the sake of which they are engaged in have already been realised for some length of time. But in the other sense an ἐνέργεια is neither τελεία nor ἀτελής. Not distinguishing these senses, Aristotle holds that the ἐνεργείαι, while they continue, are already τελείαι *simpliciter*.

(30) Let us return to the logical difference between the transitive causal activity of an agent, and the corresponding change in the patient. Above (paragraph (27)) I claimed that the former can be shown not to be incomplete like the latter. If this is true, then the transitive activity is or resembles an ἐνέργεια. Now in one respect

activities such as building differ from the ἐνεργεῖαι of *Metaphysics* H 6, in that they are not ends in themselves. In one sense then they are "ἄτελες", since their τέλος lies beyond them, in the completed house etc. However, perhaps because of the conflation of senses of 'τέλος', Aristotle in *Metaphysics* Θ 6 overlooks the fact that from one point of view housebuilding is free from the incompleteness that characterises κινήσεις. This point of view emerges if we make a conceptual separation between the transitive activity of a particular agent, and its particular patient. By the argument of Θ 6, housebuilding counts as a κίνησις if it is tied down to a particular patient; where 'X' and 'Y' name individuals, 'X builds up Y' is incompatible with 'X has built up Y'. But instead let us particularise only with respect to the agent X, and speak not of X building Y, but of X building something, or, for short, of X building. 'X builds something' is not incompatible with 'X has built something'. 'Building something' designates an activity that the same subject can continue indefinitely, or better perhaps without a break.¹⁶ What this shows is that building something has no inherent limit. It is not a process of acquiring a new property.¹⁷ If it were, then the subject

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16. Cf. E. McMullin, 'Four Senses of Potency', *The Concept of Matter in Greek and Mediaeval Philosophy* (ed. E. McMullin), p. 313: '[Learning, healing and building] as they stand, do not exemplify "terminating" activities, as they purpose to [*sc.* in *Metaph.* Θ 6]. One, having built, could still have the ability to build. To see them as "terminating", they must be particularized (building a particular house, learning a particular theorem ...).' However, McMullin is mistaken in classifying learning along with the other two examples. The schema in paragraph (31) shows that learning is a κίνησις in its subject, while healing and building are not.
17. This gives a foundation for Aristotle's statement in *De Anima* II 5, 417b8-9: 'It is wrong to say that the thinker, when he thinks, is altered (ἀλλοιοῦσθαι), any more than the builder when he builds.' Note that Aristotle here takes it for granted that the builder is not altered: he is arguing for extending the

(the agent) would have to lose this property before re-engaging in the process of acquiring it, and therefore there would have to be an interval between successive acts of building during which the loss of the acquired property took place. By contrast, 'being built up by something' does designate a process involving a necessary break before the same subject can undergo it again even at the hands of a different agent. If Y is being built up, a limit is eventually reached, and Y must undergo some contrary change before being built up again; but X the builder does not have to be "unbuildered" before building again.¹⁸

same concept to the thinker. His point is that builder and thinker are not patients; but given the principle that every κίνησις has an agent (*i.e.* is a form of passivity), this entails that they are not as such subjects of κίνησις. Again, *Eth. Nic.* X 5, 1175a34 - 35, where Aristotle mentions 'lovers of housebuilding', may be another passage showing tacit recognition that housebuilding is not a κίνησις like becoming a house. This interpretation would be justified if in *Eth. Nic.* X Aristotle clearly laid it down that enjoyment relates only to activities that are not κινήσεις but ἐνέργειαι in the narrow sense opposed to 'κίνησις'. In that case, what the lover of housebuilding loves would, in this context, count as an ἐνέργεια in the narrow sense. But although in *Eth. Nic.* X Aristotle states that enjoyment itself is not a κίνησις, he nowhere explicitly denies the possibility of enjoying κινήσεις. Cf. G.E.L. Owen, 'Aristotelian Pleasures', *Proceedings of the Aristotelian Society* LXXII, 1972, pp. 135 ff., esp. pp. 146 - 147. (However Penner, *op. cit.*, pp. 446 - 450, in a very acute discussion takes the view that an enjoyed activity functions logically like an ἐνέργεια in the narrow sense).

18. I have drawn upon the ἐνέργεια/κίνησις distinction as presented in *Metaph.* θ 6 only in order to show that the logic of causing change differs in at least one important respect from the logic of (intransitive) changing. I have not here attempted a full treatment of the distinction. Two major issues in particular have not been discussed: (a) the question whether for ἐνέργεια-values of 'φ', 'X φs' entails 'X has φed'; and (b) the 'quickly/slowly' criterion for κίνησις that Aristotle advances in *Eth. Nic.* X 3, 1173a31 - b4. As to (a), although in the *Metaphysics* passage Aristotle makes the distinction in terms of the incompatibility of 'X φs' with 'X has φed' where 'φ' denotes a κίνησις

(31) If the distinction of *Metaphysics* θ 6 is extended to cover activities not tied down to particular subjects and objects, it becomes the basis for a classification of grammatically transitive verbs which will show (a) whether such a verb implies change at all, and (b) whether, if it does, the change is to be located in the subject or the object. Thus:

- (i) If 'X ϕ s Y' is compatible with 'X has (just) ϕ ed Y', then the activity of ϕ ing implies no change in either X or Y.
- (ii) If 'X ϕ s Y' is incompatible with 'X has (just) ϕ ed Y', then ϕ ing involves a change in either X or Y. This holds of e.g. 'builds', 'learns', 'makes thin'.
- (iiiA) For all verbs ' ϕ ' falling under (ii): If 'X ϕ s Y' is compatible with 'X has just ϕ ed Z' (where 'Z' names a particular object other than Y), but 'X ϕ s Y' is incompatible with 'W has (just) ϕ ed Y, (where 'W' names a particular subject or agent other than X),

(so that it would appear that for ἐνέργεια-values, it is the compatibility of the two sentences that is being emphasised by contrast, rather than any entailment relation), Ackrill argues convincingly on the basis of other passages that Aristotle also holds the stronger position: that for ἐνεργεία, ' ϕ s' entails 'has ϕ ed'. Penner too takes this view. Now on the entailment criterion, 'building something' would not denote an ἐνέργεια. But as Ackrill points out, many apparently obvious examples of ἐνεργεία (such as seeing a play) seem not to count as such either, by this rule. Hence I would not regard the failure of 'building' to meet the entailment criterion as telling against the view that building should be classified as an ἐνέργεια no less than seeing. Potts and Penner both indicate ways in which the troublesome ἐνεργεία noted by Ackrill could be accommodated to the entailment criterion. Penner's remarks are especially relevant since he explicitly refers to transitive causal activities such as building. As for the second point (b) above, it is not clear whether Aristotle means 'A κίνησις takes place quickly or slowly' as a necessary, or as a necessary and also sufficient condition for κίνησις. If the latter, then building would seem to count as a κίνησις by this rule. (But for a different interpretation, see Penner, pp. 446-448.) However, the determination of issues (a) and (b) does not affect the position for which I have argued in the text, *viz.* that from one point of view, building etc. are to be classed as non-changes in their subjects.

then the change indicated in a general way in (ii) is to be located specifically in Y, not X. This holds for 'builds', 'makes thin'.

- (iiB) For all verbs ' φ ' falling under (ii): If ' $X \varphi s Y$ ' is compatible with ' X has (just) φ ed Z ' (Z being other than Y), and is also compatible with ' W has (just) φ ed Y ' (W being other than X), then the change indicated generally in (ii) is to be located specifically in X , not Y . An example would be 'comes to know', with ' X ' as grammatical subject, and a phrase designating some "object of knowledge" as object. The condition holds good for different kinds of objects of knowledge (or, alternatively, different kinds of knowledge): *e.g.* this man (acquaintance); that today is Wednesday (propositional); the art of bookbinding (knowledge-how). The same object can both come to be known and have come to be known - by different subjects, just as the same builder can build and have built different buildings. This shows that coming to be known no more implies that the known acquires a new property which it must lose before coming to be known again (*i.e.* by someone else), than building confers upon the builder a property he must get rid of before he builds again.¹⁹

(32) It must be stressed that the concept of $\kappa\acute{\iota}\nu\eta\sigma\iota\varsigma$ sustaining this classification is not simply the concept of a process that necessarily (even in the conceptual sense of 'necessary') results in a new state of the subject. It is, rather, that of a process properly defined as tending to result in a certain state, and whose occurrence in a given subject is grounded on the subject's not being in that state.

19. Cf. my article 'Affecting and being Affected', *Mind* LXXIX, 1970, pp. 92 ff.

This distinction between necessary results and results definitive of the process solves a puzzle which would otherwise cast serious doubt on the ἐνέργεια/κίνησις distinction of *Metaphysics* Θ 6. Readers of this passage may well be left with the sense that ἐνεργείαι, since they are not changes, are somehow supposed by Aristotle to be outside time, or else to be in time in the way that static conditions are, homogeneous throughout their duration and permitting within themselves no distinction of "before and after". But it is clear from his examples that Aristotle is not confining the term 'ἐνέργεια' to conditions in which the empirically identifiable subject is in any ordinary sense static. The most obvious example is "living", but the cognitive activities thinking and seeing also illustrate the point, for Aristotle does not use these terms only of fixed contemplation resting in a single object. Discursive thought is for him as much an ἐνέργεια as intuitive.²⁰ This may lead us to think that since the empirically identifiable subject is not static, he must mean that ἐνεργείαι, since they are not changes, really pertain to timeless non-empirical subjects. This conclusion might be welcomed by some as tending to support certain of Aristotle's metaphysical doctrines (those concerning the active intellect and the God of *Metaphysics* Λ). But at the same time it renders the method of classification in Θ 6 thoroughly dubious. For that classification depends on the analysis of tense relationships holding of ordinary verbs in ordinary language,²¹ and these verbs are predicated of empirical subjects and the conditions for

20. Cf. Ackrill, *op. cit.*, pp. 132-133.

21. However, cf. A.P.D. Mourelatos: 'The doctrine that "enjoyment is energeia" is a metaphysical doctrine; it does not simply record usage, ordinary or Aristotelian; it interprets it and it corrects it.' (*Philosophical Review* LXXVII, 1968, p. 516.) No doubt Mourelatos would say the same of the ἐνέργεια/κίνησις distinction itself.

their application are empirically verifiable. Thus the analysis would appear to be self-refuting if it yields a classification one of whose divisions makes sense only in connection with timeless metaphysical subjects.

(33) But this problem arises only if we ignore the distinction stated above. There is no reason why we should not think of an ἐνέργεια as a process necessarily resulting, on each occasion, in new states of its subject, provided we do not define it as the acquisition of a given state, or take its occurrence to be grounded on the latter's absence. The activity of thinking, for instance, and also of seeing (if by 'seeing' we understand, as Aristotle often does, a cognitive activity, not a mere state of consciousness), might be said necessarily to leave "traces", *i.e.* memories, increased understanding, etc. A man might reasonably be said not to have seen a play even if he sat through it awake and with his eyes open, unless for some time after he could tell others about it, saw things in the light of it, found it more familiar on another occasion, etc. And the fact that one may think about so and so even though one has already thought about it, is not in general due to the previous thinking's having left no trace, but to the subject's not being readily exhausted. And if a process of thinking left no trace, how could the different stages within one such process do so either? But if not there could be no reasoning, since this involves reaching new stages by means of results carried forward. But although an ἐνέργεια may of necessity result in some specific state new to the subject, this does not define what that ἐνέργεια is. Acquiring memories of watching *The Tempest* is not what watching *The Tempest* is or consists in. If it were, then indeed

specifically the same ἐνέργεια could not be immediately repeated (or indefinitely continued), since repetition of it would be repetition of a process defined as bringing about a state of a given kind; which entails that the instance of this state previously achieved must first have disappeared for there to be room to achieve a new instance of the same. As it is, a new instance of the same type of ἐνέργεια can take as its point of departure the state achieved through a previous instance.

(34) This discussion arose out of the comparison we drew between the operation of an agent, *e.g.* a builder, and ἐνέργεια as contrasted with κίνησις in *Metaphysics* Θ 6. Let us return now to the concept of the unchanging agent, and relate certain results so far reached to the questions raised in paragraphs (19) - (20). Our discussion has shown that for Aristotle no more than for Hume does the agency of the agent consist in a mysterious extra change which is the agent's exercise of its "efficacy". The only change, when X acts upon Y, is the change in Y: this is the same concrete event as that which is described as 'Y's being acted on by X', and this in turn is the same concrete event as that which is described as 'X's acting upon Y'. All the same, it might be replied that although X's acting upon Y is the same concrete event as Y's changing to some new state of itself, this change does depend on the agency of X, since otherwise why should we speak of agency at all? So that X's agency must be something more than the mere change in Y. And even if this "something more" is not a change in X, it does not follow that it is not something in X, some event or process or operation, and in showing that this cannot be a change, our discussion has not shown what it is. And if, as seems

likely, whatever it is is not empirically identifiable, then is it something mysterious and metaphysical; or is it nothing? If the latter, what is to be gained by speaking of agency at all as if it were something; and if the former, what place can it possibly have in a scientific account of nature?

(35) On one level Aristotle can answer these questions in a way that even Hume would approve. In III 3, 202a7 - 8, he says: 'Change is the actuality of the changeable, insofar as it is changeable, and this comes about through the contact of the changer'. A type of case that obviously fits this is heating, already mentioned in III 1, 201a21 - 22. A hot body causes a body in contact with it to get hot; it thereby loses heat itself and becomes cool, so that the action is reciprocal. But the hot body's heating of the other does not consist in the change to coolness which the former thereby suffers, although this is an inevitable consequence. In fact, the heating by the initially hot body does not consist in any isolable doing: for the heat to be "imparted", all that is necessary and sufficient is contact (or the appropriate proximity) between the hot body and a suitable patient. Under these conditions the latter simply gets hot. So far Aristotle hardly differs from Hume. But the advantage is all on Aristotle's side when we consider the significance of this shared position for each of the two philosophers. In Hume's eyes, it is the 'most violent of [his] paradoxes' that transitive causal activity should consist, objectively, in nothing but what has just been mentioned. His problem now is to explain why we, Hume himself included, should have thought that there was more to causality than events in conjunction; and the explanation can refer only to subjective conditions, since Hume has eliminated the

possibility that any extra objective feature of the external situation provides us with the idea of necessary connexion. However, Hume's subjective impression would not be needed to fill the gap left by his analysis of the external agent-relationship unless there were a gap to fill. And there only is one because he assumes that if transitive agency were anything real and objective, it would consist in something extra, a *tertium quid* between objects. Since this is not conceivable, let alone identifiable, he must end by denying the reality of transitive agency. But this conclusion depends on that assumption, and the assumption presupposes that the objects themselves are intrinsically non-dynamic, an inevitable position for the empiricist who insists that power is not present in objects because its presence cannot be perceived. Thus "connection", if it exists at all, must lie outside and between what is connected, and if this is impossible, "connection" is a figment of imagination.

(36) But within a conceptual system such as Aristotle's it is no paradox that the transitive activity of heating should consist simply in the fact that a suitable patient Y becomes hot when in contact (or whatever degree of proximity) with a hot body X. The objects are in themselves essentially dynamic. Given that it is the nature of fire to fly upwards, there is no need and no room for some further activity, a *tertium quid* binding the fire to its own actual natural movement. If this were necessary then it would be false that the fire of itself shoots up unless prevented. If the concept of natural change in the self-same natural substance is intelligible, why should it be any less intelligible that natural dynamism should issue also in changes in other subjects? If the parallel is accepted, there is

no place for the idea of an extra link negotiating the efficacy of agent on external patient.²² The potential agent would not be a potential agent if on encountering the potential patient under suitable conditions it needed some further metaphysical mechanism by which to administer its effect. Aristotle's system excludes a *tertium quid* "between" agent and patient not because there is for him no efficacy in the world, but because efficacy is anyway present, in substances whose nature it is to have change happen in and around themselves.

(37) So far we have considered only the example of heating. But does contact suffice for the change in all cases of transitive action? In III 3 Aristotle's illustrations are teaching, building and healing. In VIII 4, 255a34 - b2 he says:

'In all cases, whenever that which is capable of acting and that which is capable of being acted on are together, that which is potentially so and so sometimes becomes actually so and so, as for instance the learner, from being potentially so and so, becomes potentially something else.'

('Potentially something else' refers to the fact that the actuality which the learner acquires through learning is not the actual exercise of knowledge, but the (actual) power to exercise it.) The apparent discrepancy between 'in all cases' and 'sometimes' led Ross (*Aristotle's*

22. Cf. H. Carteron, *La Notion de Force dans le Système d'Aristote*, p. 168: 'Aristote considèrait l'action à expliquer comme aussi évidente que le mouvement lui-même.' Also: 'Voilà pourquoi la difficulté sur la dualité de l'acte dans l'actif et le passif (202a21) est appelée logique, tout comme les difficultés des Eléates sur le mouvement. C'est que la communication du mouvement est aussi évidente que l'existence du mouvement et de la nature.' (*Ibid.* f.n. 773) In Carteron's view, Aristotle has for this reason failed to explain transitive agency or even to see the problem it poses. But I cannot find in Carteron a clear statement of what kind of explanation he holds to be lacking.

Physics, p. 696) to prefer a less well-authenticated reading which omits the 'sometimes' (ἐνίοτε, line 255a35). But there is no contradiction if we take 'in all cases' to mean 'in all types of case'. If this is the correct reading and interpretation, then Aristotle here shows himself reluctant to assert that contact alone between potential agent and patient is sufficient for the change in the latter. He is surely right, since in all cases a further condition must be met, *viz.* the absence of external interference to the change. But his choice of example (teaching/learning) suggests that he may have something more in mind. Where the change in question is heating, cooling and such-like, contact and the absence of interferences are doubtless jointly sufficient. But it would be implausible to suggest this of a change such as learning. It is not just that 'contact between agent and patient' cannot here be given a straightforward spatial meaning, since some sort of mental "contact" is necessary between teacher and pupil. There is also the fact that even when the latter has been established, and nothing interferes, something more seems necessary for actual teaching and learning to occur. Or at least, they do not necessarily occur under the conditions just stated. So the question is what else does Aristotle suppose is needed to convert his 'sometimes' into an 'always'? There can be no clear answer to this until we are told how much to include under (mental) "contact". Does it, for instance, involve the mutual recognition of willingness to teach and to learn? But granted the existence of "contact" even in this rich sense, and the absence of interference, the teacher must surely also do something in order to set going the learning-process. In short, this case is not at all like that of heating. In heating there is no reason to postulate an extra activity whereby the hot body propagates its heat once contact is established under suitable circumstances. But unless

the teacher, apart from standing in the correct relation to his pupil, also engages in a definite activity of propagating knowledge, the pupil will not learn.²³

(38) We may begin to wonder whether Aristotle's vagueness on this matter is not intended to blur the awkward fact that the teacher's teaching comprises various performances which we should be hard put to it to describe without implying that he himself, the agent, (intransitively) changes. The builder gives still more cause for suspicion. Yet Aristotle must mean his general account of agency-patency to cover building, since building is his paradigm of change in III 1, and the problem of change is there treated as inseparable from the problem of agency. The difficulty cannot fairly be evaded by saying (in line with the doctrine as yet to emerge from Book VIII) that the real cause of change is an immaterial unchanging something "within" the builder, with the builder's changing body functioning only as a mediating or instrumental cause. In the first place, by any ordinary standard it is no less clear that the builder, while operating, changes mind-wise as well as body-wise; so that the alleged unchanging cause would be neither mental nor physical, or else is as likely to be either as the other. Secondly, we are at present following Aristotle in his attempt in III to elucidate the general features of agency and patency, and he is attempting to do this by reference to the most obvious type of case, where one substance changes another external to itself. Thus we are entitled to expect him to

23. As Philoponus says (*ad* 202b7, Vitelli p. 381, 15 ff.: 'εὐ γε καὶ παρόντος τοῦ μαθητοῦ εἴπη μὲν ὁ διδάσκαλος μὴ δρᾶση δὲ εἰς τὸν μαθητὴν, οὐ λέγεται διδάσκειν.'

make good the general claim that 'the change is in the patient' (not, therefore, in the agent) without reducing interaction between distinct substances to the problematic case in which the rôle of agent is played (or supposed to be) by something that is not a distinct concrete substance at all, but a factor "within" one. After all, we say that it is the man who builds, and the man is an embodied being, not an unmoved mover within a human body. It may be that even if Aristotle cannot show satisfactorily that there is no change in the man as agent, he will still, by some special argument, be able to arrive at the supreme Unmoved Mover of Book VIII. But he will not be justified in relying for support on any general presumption that a changer as such does not change, if in some cases (indeed, the most obvious) this has proved false or even absurd. To maintain this assumption intact, Aristotle would either have to deny that the empirically identifiable changes in the mind and body of the builder are changes at all, or he would have to say that they have nothing to do with the builder's activity as agent. Both alternatives seem absurd, and the second implies, in addition, that the "real" building activity, since it is not to be identified with any visible goings-on, must be something wholly mysterious and indescribable.

(39) So far as the second of these alternatives is concerned, it is hard to believe that Aristotle himself would not be the first to scoff at the idea that the builder's bodily and mental movements have nothing to do with his building. On the contrary, they are what constitute it. The problem then is this: The discussion of the ἐνέργεια/κίνησις distinction showed that building is not a change in the builder, in the sense that building is not a process defined in

terms of a new state to be achieved in the builder himself. Rather, it is a process defined in terms of a new state to be achieved in the external materials. However, this purely conceptual point does not save the builder from having to stir in order to be building. There is no concrete event that displays only the definitive features of building, and no others, any more than there is in nature a form without matter. Building is not to be defined as moving one's limbs and calculating weights and positions, but these processes are the flesh and bones in which the form is realised, and what are these if not changes in the agent?

(40) It will help to approach this problem by considering the notion of a single (particular) change. In V 4, 227b20-29, Aristotle says that a κίνησις is numerically one only if it takes place (a) in a single subject; (b) in respect of one specific type of property; (c) continuously throughout the time in which it occurs. Now these remarks amount to an analysis of the concept 'numerically one κίνησις'; they do not offer criteria by which to decide in practice whether some phenomenon or other is a numerically single change. Characteristics (a), (b) and (c) could function as criteria only if it were possible to identify their presence without having first employed the notion of 'one change'. That this is not in general possible will be clear if we consider actual cases. As examples of single subjects, Aristotle mentions an individual man, a particular piece of gold. His examples of changes are: walking, becoming healthy, becoming white. These cases are very different. A piece of gold is perceptibly simple and homogeneous: its only internal "diversity" consists in its divisibility, and since this is infinite it cannot be a reason for doubting

that the piece of gold is a single subject. To say that the gold is a plurality of subjects would be to say that it is an infinite plurality, from which it follows for Aristotle that there would be no actually existing subject that was the gold. But it is otherwise with a man. Why do we not say that the many perceptibly heterogeneous parts of a man are different subjects? When a man walks, different parts of the body move differently: why do we not say that these are many changes in many subjects, but rather (as Aristotle assumes) that there is one subject, the man, doing one thing, namely walking? Our basis for seeing the man as one subject lies in precisely such facts as that the various movements of the limbs and organs are co-ordinated to some over-all result such as that of getting to a different place. Thus our notion of the unity of the perceptibly multiple subject depends on the prior assumption that the various movements make up one change, described as 'walking'. Again, perception alone can decide whether something has become white: whiteness is simple, like gold. But what about becoming healthy? This may involve what from some points of view would be described as many specifically different changes, in temperature, in position of parts, in size and shape, etc. Again what from one point of view may be a new change may from another be the continuation of a change that was already occurring. The bronze is melted, then it is poured into the mould, but the same process is going on all the time, the production of a statue.

(41) We have already seen (*e.g.* Chapter III, paragraphs (10) - (11); *cf.* also Chapter V, paragraphs (35) - (36)) how Aristotle's theory of substance necessarily favours the adoption, in a particular case, of a standpoint from which what might otherwise be regarded as a

multiplicity of distinct objects and distinct changes are seen as composing one object and one change. This is not to say that the theory of substance provides a licence for indiscriminately viewing any and every phenomenon as parts of some single unit. The point is rather that since every phenomenon must be traced back in the end to some one substantial principle or nature, we are not entitled to look upon a particular phenomenon as lying "outside" a whole composed by other phenomena unless there is reason to suppose that the former manifests a different principle from the latter. Now the empirical criteria for deciding whether a given phenomenon is to be included in one whole rather than in another may be difficult to spell out, and one may well suspect that the decision-procedure will involve conceptual circularity of some sort. This is a problem of methodology rather than metaphysics. Aristotle would not, I imagine, be disposed to give up his metaphysics on account of it, just as there are latter-day philosophers who remain faithful to the 'analytic'/'synthetic' distinction despite a similar difficulty. This however is a general problem, and at the moment we are concerned with the particular question of how it is that an agent can be thought of as not changing even though it is only through its changes that some other change is effected in an external object. I suggest that the "unifying" approach just mentioned can solve this problem, whatever the general difficulties attending such an approach. (These are no more severe, so far as I can see, in this connection than in any other.)

(42) The material used by the builder, always referred to by Aristotle in the singular as 'τὸ οἰκοδομητόν', consists in many different things, wood, stones, etc., which are seen as one only in relation to

the one end. Again, the processes undergone by these are different: hewing, planing, positioning, etc., but they all constitute the one process of becoming a house, for the same principle controls them all. But are not the builder's bodily and mental movements also parts of this one process even though their subject is not one of the materials? They are not logically distinct changes from the change we call 'becoming a house', for their end is the same, that there should be a house. And the *raison d'être* of the changes in the agent is the same as that of the changes in the materials: it is the potentiality of there being a house. If the singleness of the end justifies us in seeing the perceptibly different changes in the materials as parts of one process, why should it not justify seeing the changes in the agent as parts of that same process? If instead we take them as logically self-contained changes, then we must suppose them to be completed on reaching the end-states in which they terminate. Thus if the builder, in building, raises his arm and this is a self-contained change, it is complete when his arm is up. But this description is actually self-contradictory. Insofar as he is a builder, the change of which he is the source is only completed with the emergence of an edifice. Thus if he is also regarded as the source of a change that is completed by a certain position of his own arm, it must be assumed that it is not *qua* builder that he is the source of this change. But this is absurd, since the arm-raising is not a *per accidens* accompaniment of the building but part of carrying it out. It follows that he can only be taken to raise his arm *qua* builder building, if the arm-raising is not treated as a self-contained change. In this sense, then, what takes place in the working agent is not a change, although it is not a condition of rest either.

(43) Since change is the coming to be of some new state in a substance, and is grounded on the substance's not yet being in that state, it is natural to designate this substance the 'subject of change'. But now the case of the builder presents a problem of terminology. For here the change, which is the coming to be of a house-structure, takes place (or certain stages of it do) in another substance, the agent. Movements of his are parts of the change, and these movements are in him. Yet if we said that the change is in him as subject, this would seem to imply that the builder turns into a house. Some type of term is needed to convey the builder's connection with the change which does not imply that he is subject of the end-product. This descriptive function is performed by transitive verbs of agency. 'X builds' indicates (a) that X is no less necessary to the one change than the genuine subject, *viz.* the materials; (b) that the one change does not have X as subject; and (c) that whatever does occur in X that is relevant to the one change is not a distinct and self-sufficient change in X. We can now see that Aristotle's retention of the language of agency has nothing to do with any postulation of a mystical (and mythical) transaction tying agent to patient, or to its effect in the patient. Aristotle, from all that we have seen, could have joined heartily in Hume's conclusion that all that happens is (a) certain behaviour in one object, and (b) a change culminating in a new state of some other object; although Aristotle's reasons would be the reverse of Hume's. And where the agent-object is a creature incapable of "telling its purposes", he would have agreed that regular conjunction of similar events is our primary clue to the existence of a connection. 'What happens by nature happens always or for the most part' (*Physics* II 8, 198b34 - 36). But what Aristotle could not allow is a Humean description of the two sides of

the causal relationship as a pair of conceptually distinct and self-sufficient changes. The language of transitive agency makes it possible to register the fact that the change has two sides and involves two objects, without implying that there are two changes. Thus while 'builds' represents nothing extra going on "between" X and Y, it is not on that account eliminable from a correct, and from Aristotle's point of view, a scientific account of the situation.

(44) There is however another way of viewing the matter, one which undercuts altogether any attack on 'agency' as introducing a non-empirical relationship. Instead of identifying "the change" with the coming into being of some new state, let us follow Aristotle in III 3 in treating it as one concrete event in which the agency of one being and the patiency of another are distinguishable but inseparable aspects. Now if we consider this event prior to analysing it into the two aspects, can we say that two different beings are involved in it? What we call the agent and the patient are of course perceptibly and spatially different. But Aristotle would not in general take this as a sufficient criterion for there being distinct beings or substances: *e.g.* the organs of an organic creature are not different substances. And in the case which we are considering, we cannot distinguish one being as that in which the new state happens, and the other as that which contributes to this without itself suffering the new state, since this distinction presupposes that the concrete event has already been conceptually split into its two aspects. It seems then that considered prior to analysis, this event occurs in a single subject, which only upon analysis reveals different factors, an agent and a patient. Now although Aristotle's analogies in Book II between

natural and artificial change are intended to illustrate the former by the latter, why should we not reverse the analogy, and regard the artifex and his material as forming, in the change, a concrete organic unity, as if the material were an extension of his own body?²⁴ What happens in the one and what happens in the other have the same end and are from the same principle. Such a consideration is what justifies thinking of the parts of one body (in the ordinary sense of 'one body') as an organic unit; so let it justify a similar view in this case. However, the difference between this case and a real case of natural change in a single substance, is that in the former, the "organic unit" exists as a unit only during the change. In particular, the change terminates in the unit's dissolution into two free-standing substances, one the house and the other a being capable of entering into similar "organic" relations with other sets of building materials. And it would be a strange natural substance indeed whose natural change necessarily resulted in its own dissolution! However, if we may disregard this important disanalogy in order to finish the conceptual picture, let us say this: it is only because there are two distinct beings before and after the change that we assume that there were during it too. The two distinct being are materially continuous, both before and after, with the one subject of the change as it actually occurs. But is this a reason for supposing that during the change there were two actually distinct beings involved? Surely not, any more than the fact that different simple bodies are yielded up when an organism decomposes would be, for Aristotle, a ground for saying that they were actually present as their distinct selves during the

24. Cf. *De Mot. An.* 8, 702a31-b6 for a comparison of a stick moved by the hand to an extra limb.

life of the creature.

(45) If this view of the matter is not too far-fetched, then nor is its implication, which is that there is no actual agency and patiency. In the change as a concrete unitary event there are not different entities to be agent and patient. The active and passive of the verb, from this point of view, are used of the change itself only derivatively, on the basis of an actual distinction existing only *ante* and *post eventum*. We cannot even call the two beings the 'potential agent and patient', since this implies that they could be actually so. But they could be actually so only in the actual change, and in the actual change they are not distinct and therefore not agent and patient. At any rate, on this account the question 'What is it that takes place when agency takes place?' cannot arise. Since there are not two beings to connect, there can be no mystery, nor any attempts to reduce any mystery, about the nature of the connection. If we and Aristotle find this account unacceptable, the reason, I suggest, does not lie with the concept of change as such, but with the structure of the concepts we use to describe our own practical activities. Suppose we intend to produce some change in an object other than ourselves. Then in the event, if all goes well, we do what we earlier intended. If we describe what we are doing while doing it, the description differs only in tense from the verbal expression of the prior intention. So in seeing ourselves as executing the intention, we see the actual happening as of the same logical structure as the intention itself. But in the intention, which preceded the change, the object-to-be-changed figured as something distinct from ourselves, and therefore even when the change is actual it continues to figure

as distinct. In other words, when the change is one that we bring about in an external object, we cannot primarily view it as a concrete event undifferentiated into the two aspects of agency and patiency. The point of view of the human agent is one from which the two "halves" already present themselves as distinct.

(46) Any further discussion of the issues that open up here would take us far afield from Aristotle, who never follows out the line of thought just sketched, although his conception in III 3 of the concrete unity of change may be said to contain its germ. While the account just given brings the obvious, mutually external, cases of agent and patient under a schema predicating a single undifferentiated development of a single unitary subject, Aristotle himself travels in the opposite direction. He looks for agency and patiency even in the apparently intransitive changes of single living organisms, beings which for him are unitary not in some esoteric sense that stretches the conceptual imagination, but fundamentally and paradigmatically so. To this, the topic of "self-change", we now turn.

CHAPTER V

Self-Change and the Eternal Cause

(1) If Aristotle is in general elusive on the subject of agency and its connection with change, nowhere is he more so than when treating of the mysterious concept of something's 'changing (transitive) itself', or being 'changed by itself'. The import of this concept, the grounds of its application, its point and its relation to other Aristotelian notions are all more or less obscure. But these obscurities especially demand elucidation not only because of the intrinsic interest of the idea of something's being changed by itself, but also because this idea plays a crucial part in one of the most important arguments of the *Physics*. This is the massive argument of Book VIII in which Aristotle seeks first to show that change never was nor will be absent from the universe, and then to show the nature of the cause on which this fact depends. It might seem that the subjects of Book VIII, namely the eternity of change and the eternal cause of change, are remote from the central topics with which we have so far been concerned, *i.e.* the conceptual structure of change as such and its relations to substance and to agency. For in considering these questions we have so far found it unnecessary to assume that change either is or is not an eternal feature of the universe, or to investigate what follows from either of these suppositions. Given that change exists, which in a work on "physics" cannot even be questioned (I 2, 184b25 - 185a3; 185a12 - 16; VIII 3, 252a32 - 253b6), we have followed Aristotle in his analyses of what change involves and presupposes when and where it does exist, and these analyses have made no reference to the actual distribution of change through time (or for that matter through space).

However, as will emerge from the ensuing discussion, the conclusions of Book VIII have a vital bearing on the validity of Aristotle's original notion of natural substance put forward in II 1. In particular, the proposition that there never was nor will be a time without change may be regarded as underpinning the fundamental conception of the nature of a natural substance as an inner principle of change. Aristotle demonstrates and defends the aforesaid proposition in the first two chapters of VIII, and devotes the rest of the book to spelling out certain presuppositions and consequences. It is in the course of this reasoning that 'change by self' or, as I shall usually call it, 'self-change' makes its sole appearance in the *Physics*, in VIII 4-6.

(2) The concept is first introduced in a section where Aristotle means to establish that whatever changes (intransitive) is changed 'by something' (Chapter 4). 'By something' is used by him to cover two alternatives: 'by something other', and: 'by itself' (255b31-256a2). Now at first sight it may look as if something's being changed 'by itself' means the same as something's changing naturally or by its own nature. In speaking of natural change, we have sometimes described the object as changing 'of itself', and Aristotle speaks of the nature of a natural substance as a principle of change 'within itself'. These reflexive locutions are perhaps easily confused, but for Aristotle they represent distinct concepts.¹ He makes it quite clear in 4

1. Cf. O. Hamelin, *Le Système d'Aristote*, pp. 325-326, L. Robin, *Aristote*, pp. 125-126, and W.D. Ross, *Aristotle's Physics*, p. 435. By contrast, F. Solmsen speaks in vaguely general terms of 'nature as self-moving principle' ('Platonic Influences in Aristotle's Physical System' in *Aristotle and Plato in the Mid-Fourth Century*, edd. Düring and Owen, p. 227). It is true that

(especially in the summarising lines 255b31 - 256a2) that the class of beings that can be said to be changed by themselves is only a subdivision of the class of beings that can be said to change by their own natures. Self-change belongs only to living creatures (or animals: Aristotle seems to hover between these two positions²). But the realm of natural substances includes also the inanimate bodies, fire and earth, etc., or, as he here terms them, the light and the heavy (255a2 ff.). And Aristotle is no more disposed to deny natural movements to these substances in VIII than when he first introduced the concept of natural substance in II 1. The distinction between natural change and change that is enforced or contrary to nature still applies in full force to the inanimate members of the physical world. Thus in VIII 4, 254b21 - 22 he writes: '... some things change (*κινεῖται*) by nature, others against nature. Change against nature is illustrated by earthy things moving upwards and fire downwards.' These movements could not be regarded as 'against' the natures of the substances concerned unless it were still being assumed, as it was

in *Aristotle's System of the Physical World*, pp. 100 - 101, Solmsen says: 'To have the principle of motion in oneself is not entirely the same as to be moved by oneself', but he does on (*ibid.*): 'Aristotle himself seems at times to regard the two notions as synonymous', citing 254b14 ff. But this passage implies only that change 'by oneself' counts as natural change, without any hint that the converse is also true; hence it affords no evidence of even a temporary assumption of synonymy on Aristotle's part. (Possibly Solmsen's interest in Platonic influences misleads him here: what Plato calls 'self-change' corresponds, in his system, to 'natural change' in Aristotle's in that for Plato 'self-change' denotes the type of change that is primary and presupposed by any other. See footnote 23.) It is unfortunate that H. Cherniss too (*Aristotle's Criticism of Plato and the Academy*, Appendix X) uses 'self-motion' and 'moves itself' of any change not externally determined, although he is well aware that this is not Aristotle's meaning (*ibid.*, p. 590). For similar misleading language see also W. Charlton, *Aristotle's Physics I, II*, p. 92.

2. See footnotes 4 and 28.

originally in II 1, that they have natural directions of motion too. And in 4, 254b16 - 17 Aristotle recalls his original definition of nature as an inner principle of change with the following remark: 'We say that whatever has the principle of change within it changes by nature'. It is almost as if he is here warning us against supposing that the newly introduced term 'changed by itself' implies any revision in content of his initial concept of nature. But it would be strange indeed if in the same context he were then to put forward a doctrine entailing a radical departure from his earlier view concerning the extension of this concept. Yet this in effect is what Aristotle would here be doing in VIII 4 if he meant by 'self-change' the same as what he earlier meant by 'natural change'. For this equation of the two terms would entail that on the theory of VIII 4 the concept of 'nature' applies now only to animate things, since these alone merit the title 'self-changers'.

(3) It is precisely because Aristotle does not equate natural change with self-change that he is faced here with what he regards as a particularly knotty problem, that of showing how even in their natural motions the simple bodies can be properly described as moved by something. For they are not moved by themselves; and the absence of any external determinant to enforce the pattern of movement makes it look as if it is wrong to speak of them as moved by anything other than themselves. But this Aristotle cannot accept, for he would then have to say that they are not moved by anything, but simply move, which contradicts the conclusion towards which he is steering, that every change is a change by something. In the end, and with considerable effort, he argues that a simple body in its natural motion is

"moved by" those external substances responsible for the motion either through having produced the body in the first place or through removing hindrances (*v.s.* Chapter IV, paragraphs (10) - (11)). Thus he is willing to extend the phrase 'changed by something other' so as to cover two such different dependence-relationships as (a) that between an object changing against its nature and the external object that enforces this change, and (b) that between an object changing naturally and those external objects that make or have made this change possible. We may well suspect any doctrine that requires such a blanketing of differences, but Aristotle's deliberately indiscriminate use of 'changed by something other' puts him at a strategic advantage *vis à vis* the question of what exactly we are to suppose could be meant by something's being changed 'by itself'. What relationship can a thing have with "itself" that would justify describing it as both agent and patient of its own change? But by using 'changed by something other' to cover such diverse relations, Aristotle in effect establishes for 'changed by -' a meaning so wide and abstract that the reader is in no position to complain at its further extension to the reflexive case, or to object if no obvious image comes to mind to illustrate this latter application.

(4) All that we have so far gathered concerning change by self, or self-change, is that it is natural change, and occurs only in animate beings. In what then does it differ from the natural change of the inanimate? The term might seem to hint that self-change is more self-sufficient. But in general this is not so. For if it is true to say that an inanimate thing in natural change is changed by things other than itself, on the ground that other things are responsible for

its existence and for its free path, then it is equally true to say this about a living thing in its natural change, which is self-change. A creature that is changed by itself at the same time owes this change to external factors. Aristotle does not himself bring out this point, but it follows directly from the account he has given of 'changed by something other' in connection with the natural changes of the inanimate. In fact it appears from VIII 2 and 6 that the self-changes of living things are more dependent on external conditions than are the natural movements of fire and earth. The latter presuppose only (a) generation of the substance in question, and (b) conditions that make or keep the pathway clear; but the former require not only these but also (c) environmental stimuli that trigger the changes although without enforcing their pattern (2, 252b15-20), and (d) certain physiological conditions of the living substance which it owes to earlier interactions with the environment (such as ingestion of food) (6, 259b6-15).

(5) What distinguishes self-change for Aristotle is not superior self-sufficiency of the change as compared with change of other types, but the logical complexity of that which has the change. A self-changer, *i.e.* a substance that changes (transitive) itself, or is changed by itself, comprises within itself both agent and patient of the same change, and this agent and patient, Aristotle insists, are in some way distinct from one another. Supplementing Aristotle's account (since he himself seems resolved to say as little as possible about self-change) we may state the following analytic difference between the case in which a self-change is externally obstructed and then released, and the case in which this happens to a change that is

merely natural and not self-instigated: In the latter case, what is repressed and then released is simply a change in the object; while in the former, not only is the change first prevented, then permitted, but something else too, namely the effective exercise of agency by the agent-element "within" the object. When self-change is hindered, then not only is something prevented from changing (intransitive), but something in some sense else is prevented from producing the change. That there is some difference between changer and changed within the self-changer is one of the few points on which Aristotle is quite definite. At 4, 254b28 - 33 he asserts that there is a difference, and at 5, 257a31 - b13 he attempts to prove that there must be. The self-changer is a complex whole, in which the agent- and the patient-element are "parts". The idea of a being in which changer and changed are in no way distinct Aristotle regards as inadmissible.

(6) In this respect his concept of self-change differs radically from its Platonic forerunner. Plato had argued that every causal series of changes must have a causally first member, and that this first member is a change in which the being that changes is itself the source of its change. He described this being as 'changing (transitive: κινεῖν) itself' (*Laws* X 894 B ff.). He further argued that self-change is the defining characteristic of soul (*ibid.* 895 C - 896 A; cf. *Phaedrus* 245 c - 246 A). He regarded the soul not merely as the source of vitality in beings other than souls, but as itself enjoying the life of which it is source. Now this life he identified with motion (*Phaedrus* 245 C). On this view, then, the very same entity, namely the soul, is both source and subject of motion in itself. What is agent is also, in this case, patient: or, if the language of

'agent/patient' presupposes a distinction, then the soul must be described as in motion (alive) with a motion not due to its being passively moved by anything, even itself. To live and move is of the essence of soul, and it might well be argued that it is as absurd to describe the soul as the agent of its own essential property as to speak of the number five as the agent of its own oddness.

(7) Now Aristotle may be right in holding, as against Plato, that the phrases 'X changes (transitive) itself', 'X is changed by itself', are used incoherently unless the user would allow that there is some difference between changer and changed. But this hardly entitles Aristotle to claim coherence once this condition is met. On the contrary; if changer must differ from changed, how can 'X changes itself' escape being nonsensical or self-contradictory? On any analysis, it seems, the concept of self-change collapses, for identity of changer with changed conflicts with the meaning of 'changer' and 'changed', while their difference conflicts with the meaning of 'self'. How can it help to say with Aristotle that a self-changer is a whole of which one part, factor or element is changer, the other changed? For the changed is on this view changed by something other than itself. It seems that Aristotle's attempt to make sense of 'self-change' ends by reducing it to change by something other.³ If self-change is change in one part of a whole by another part, what is to prevent us from predicating 'self-change' of any combination of changer and changed, *e.g.* craftsman and materials, the stone and whatever pushes it contrary to its natural direction? It is extraordinary that Aristotle does not raise these problems, let alone discuss them. However it is clear enough on one

3. Cf. Solmsen, *Aristotle's System*, p. 233.

level what his answer to the last would have been. The craftsman and his materials may for some purposes be considered as a whole perhaps, but they do not form one substance, and Aristotle's self-changers are single substances, organisms. Thus the postulated difference between changer and changed within the self-changer is not such as to detract from the unity of the substance. Following this line, we may say that Aristotle's position is this: Nothing literally changes itself in the sense that would deny any difference at all between changer and changed. But this does not erase the distinction between being changed by self and being changed by something other. For these two phrases mark two genuinely different relationships: that which holds between elements which together form a substantial unity, and that which holds between beings, themselves each a substance, which together make up no more than a combination.

(8) On this account then, 'being changed by something other' refers to a relation between substances, while 'being changed by self' refers to a relation between different elements of a single substance. But how could anyone suppose that no discussion is needed to establish that the relation of 'being changed by' should be predictable on what would appear to be two categorially different levels? Yet from Aristotle no such discussion is forthcoming, and this silence of his is so striking a feature of his whole treatment of self-change that in addition to the philosophical difficulties of this concept we are faced with an extra puzzle in Aristotle's refusal to consider them. For the questions he leaves unsettled are basic on any view. What ontological status, for instance, would he attribute to the "something" in a self-changer which is identified with the changer,

and that other "something" identified with the changed? How is it possible to predicate either 'changer' or 'changed' without illegitimately hypostatizing the entities of which they are predicated? With regard to the term 'changed' this difficulty is especially obvious, as the following argument will show.

(9) Every change, at least according to the definition of Book III, results in a new state of that which has undergone the change. If the change is, as Aristotle says it always must be, a change brought about by a changer, then that which undergoes the change must be described by the term correlative to 'changer', *i.e.* 'changed'. Thus the changed is identical with that which undergoes the change. But what undergoes the change ends by being in a new condition of some kind. And in three out of the four types of change which Aristotle recognises in III, the new condition is represented by a term predicable of a substance. The new state is a quality, a size or a position in space, and according to the doctrine of the *Categories*, the subjects of such properties are substances. What undergoes a change resulting in such a property must therefore be a substance. Thus the changed in a change resulting in such a property must be a substance. And this holds true however the change in question comes about: whether, for instance, it comes about through "self-change" or through change "by something other". Thus the changed, even in self-change, must be a substance. Now Aristotle says (*Physics* VIII 6, 259b5-20 and 7, 261a23-25) that organisms have the power to change themselves only in respect of place. This view has its difficulties,⁴ but at least it shows that

4. Because according to the doctrine of *De Anima* III 9 only animals among living things have the power of natural locomotion; but if

Aristotle does not think of self-change as involving some special, mysterious and as yet uncategorised type of *terminus ad quem*. On the contrary, what changes itself moves itself from one place to another, so that what it moves when it moves "itself" must be the kind of thing of which place is predicated; *i.e.*, if the doctrine of the *Categories* is still retained, a substance. But if the changed is a substance, then is the changer something else in addition to this substance? And if so, how can the "whole" which is the self-changer be itself a substance, if it consists in a substance plus something else? On the other hand this might be condemned as a spurious paradox generated by the gratuitous introduction of terms such as 'in addition to' and 'plus'. In stating that changer must differ from changed, Aristotle does not state, nor necessarily imply, that the difference must be such that the two are addible. Perhaps then he means that in self-change, the changer, though different from the changed, is not a different individual thing or substance. Resorting to a handy word, we may say that he might mean that it is the same individual substance under different "aspects". Thus the doctor is a substance and so is the patient a substance, but not necessarily a different one. On such a view the changer in self-change is not a meaninglessly hypostatised aspect of a substance, "acting upon" another hypostatised aspect, but is the same substance, to which two different descriptions apply. This seems the most promising line of analysis, or at any rate the one least at variance with Aristotle's metaphysics, but Aristotle does not at any point steer us towards it by indicating, for instance, that changer need differ from changed only in description (λόγῳ) and

plants are not self-changers, then the division of changes in *Physics* VIII 4 into (a) counter-natural, (b) self-changes and (c) the natural changes of inanimate substances, is not exhaustive, which the argument requires it to be. See also footnote 28.

not numerically. He is as studiously vague as to the nature of the difference as he is positive that there is some difference. 'That [living things] are changed by something is clear, but what is not clear is how we ought to distinguish in them changer from changed.' (4, 254b48 - 30). But if we cannot articulate the distinction, how can we be sure that it is such as will bear the weight of the changer-changed relation? The next sentence is equally unilluminating:

'For it seems that just as in the case of ships and things not constituted by nature, so in the case of animals the changer and changed are distinct (διηρημένον), and in this way [*i.e.* only when there is a distinction] the whole changes itself.' (*ibid.*, 30 - 33)

If the illustration points in any specific direction, it is that of the metaphysically disastrous hypostatisation of changer and changed as distinct substantial entities, like ship and oarsmen. But it is more reasonable to suppose that Aristotle is here saying that just as there is some difference (whatever type it may be) between an artifact and what pushes or manipulates it, so there is some difference between changer and changed in an animal. For it is unlikely that he would have used the illustration to specify the type of distinction supposed to obtain in the latter case when he has only just said that it is not clear how this distinction should be made.

(10) Our unanswered questions have so far been of the most abstract, but even on a more descriptive level Aristotle is equally unforthcoming. Even if the metaphysical status of changer and changed in the self-changer is to be left unexplained, we might expect to be told what those features or elements or aspects are to which these rôles are assigned. Aristotle gives a list of empirically knowable criteria for distinguishing self-changers: they are alive, they exhibit more than

one kind of self-change,⁵ they have the power to stop their own changes, they are physically complex (4, 255a5-18). But the context shows that his purpose in stating this list is not to explain what is involved in self-change but rather to establish that the simple bodies do not count as self-changers. He shows that they do not so count by pointing out that they possess none of the listed characteristics of self-changers, but this says nothing as to which (if any) of these characteristics is what being a self-changer consists in, and which are merely signs and symptoms. However, Aristotle could hardly have expected his immediate audience with their Platonic background not to take him as identifying the source of self-change with soul. Soul, then, it would be understood, is the changer-element, and body therefore the changed, and being ensouled is not a mere criterion for predicating 'self-changer', but that in virtue of which the predication would be true. That this is Aristotle's meaning in or behind the text of VIII 4 may seem to go without saying.⁶ All the same, it is odd that he never once in the *Physics* explicitly identifies soul as the changer-element in self-change. However, we shall see later that this omission, if deliberate, is one for which he had good reason (*v.i.* paragraphs (33) and (37)).

(11) On the whole perhaps it is not surprising that Aristotle does not spell out an equation of soul with changer and body with changed in the case of live creatures. Given that he describes the latter as

5. Since he holds that locomotion is the only type of self-change (see paragraph (9)), this must mean locomotion in different directions.

6. Simplicius *ad* 255b28-29 (Diels 1208, 36-37): 'προφανές γάρ ἐστίν ὅτι ὑπὸ τῆς ψυχῆς κινεῖται τὴν ὡς ζώων κίνησιν.'

(sometimes) changing (transitive) themselves, it is a reasonable guess that he has this equation in mind. But what is puzzling is that he should commit himself to this description in the first place. After all, Aristotle had good reason to refuse to handle the concept of self-change at all. On Plato's interpretation it is incoherent, as he himself argues (*v.s.* paragraphs (5) - (6)), and he cannot have been entirely unaware of the problems threatening his own. Why then think of organisms as self-changing? Why not think of them as simply changing (intransitive)? Of course these substances are physically and psycho-physically complex in ways that set them apart from the inanimate bodies that also simply change. But why should we assume that the elements in the complex, however they are distinguished, stand to one another in a relation of agent to patient? It might be suggested that Aristotle has to say that organic creatures are, in their natural changes, changed by themselves, since otherwise they would not be changed by anything, which would falsify his universal principle that whatever changes is changed by something. But salvation of the principle does not require the introduction of "self-change". In denying this predicate to the inanimate bodies in their natural motions, Aristotle does not deny that they are changed by something, but identifies the agent(s) with the external substance(s) that make or have made possible those motions. Similarly, even if organisms were not said to change themselves, there would still be just such external agents of their natural changes, as we remarked earlier (paragraph (4)), so that even without self-change, it would still be true that every change, organic and inorganic, natural and counternatural, would have some kind of agent.

(12) Aristotle goes some way towards providing an answer to the question just raised when in 4, 254b17 - 20 he mentions situations in which the natural change of an organism may consist in or involve some change contrary to the natural bent of a limb or organ, or of the whole body considered as composed of a given material. Thus it is natural to a bird to move (fly) upwards, but not to the earth of which its body is mainly composed. And in some cases a creature may only be able to perform some function natural to the type of creature it is by moving some part of itself in a manner contrary to that in which the part normally moves. Thus a man might have to use his hands to walk with, or to grow upwards a plant might have to send shoots sideways at an unnatural angle. If we think of the nature of an organism as being to pursue certain biological ends as best it can, then we may say that in such cases the organism moves naturally, although some bodily part, or the material of its body, moves in a way contrary to the nature of that part or material. Thus (a) we differentiate between the organism and its parts, and between the organism and its matter; and (b) we describe their relation in terms similar to those used to describe situations in which one external substance acts upon another. The matter of the organism moves contrariwise to its nature as earth or whatever, and it does so because of the natural change of the organism whose matter it is. Thus there is a basis for applying the language of changer and changed to the organism and its part or to the organism and its matter.⁷

7. The statement that the whole organism is agent and its bodily matter or bodily part the patient may appear to conflict with what in paragraph (10) we said was surely Aristotle's implied meaning in VIII 4, *viz.* that the soul is agent. But on the doctrine of *De Anima*, whereby the soul is the form constituting the bodily parts an organic whole, these are two ways of saying the same thing.

(13) If Aristotle had confined himself to such cases when speaking of the self-change of organisms, the concept would be relatively unproblematic. At least we could understand why he uses it even though the theoretical difficulty of articulating the conceptual nature of the difference between changer and changed still remains unsolved. A similar difficulty arises over the analysis of common English reflexive phrases such as 'X controls himself', 'X makes himself eat', where what is said to be overridden is not a purely physical propensity of some physical part or component, but a desire or inclination. But inability to produce a theory explaining how the "self controlled" differs from the "self controlling", and what it is that the "one" does to the "other", does not prevent us from using these expressions in ordinary discourse, confident that they hit off something not conveyed by non-reflexive expressions such as either (a) the intransitive 'X eats', or (b) the transitive 'Y makes X eat' (where X is a different person from Y). In the same way we can see the point of reflexive expressions that imply the checking of a physical tendency. But these considerations do not ease the difficulty of Aristotle's theory, for the simple reason that he sees all cases of organic natural change as cases of self-change.

'That which is changed by itself changes by nature, as for instance each of the animals. For the animal is changed by itself, and everything that has the principle of change within itself we say changes by nature. Thus the whole animal changes itself by nature, but its body can change both by nature and against nature. It depends on what type of change is occurring and on what type of element constitutes the body.' (4, 254b14 - 20)

Here Aristotle shows that he would describe the animal as a whole as changing itself by nature even in the case where its body and bodily parts follow the natural tendencies specific to each. Thus when the man walks on his feet, and when the bird swoops downwards, allowing the

downward tendency of its earthy component for the moment to take over, this according to Aristotle is not merely natural movement of the whole, but self-movement. Now it is true that the drop of a bird that lets itself drop is, as we say, controlled, since the bird can check it and gear it to the purpose in hand. This power to check a natural motion, we recall, was one of Aristotle's criteria for being a self-changer. But in ordinary discourse, the fact that the falling creature can stop itself, and can move upwards against the weight of its body, would not license the description 'It makes itself move down'. Nor would it be correct to say of someone who is following a strong inclination to eat, but who can all the same do what might reasonably be described as 'stopping himself from eating', that he 'makes himself eat'. Ordinary discourse, in other words, applies the language of self-change to movements and actions that are actually contrary to nature or inclination, not to those which are not, even when they are such that it is in the agent's power to halt them in the face of nature or inclination.

(14) The reason, I believe, for Aristotle's failure to discuss or even acknowledge the difficulties we have been surveying is this: the concept of living things as self-changers figures in *Physics* VIII not as an item of any interest in itself, but purely as a step in an argument concerned with other issues. 'Self-change' tells us nothing about organic substance, nor about the agency of beings familiar to our experience. It is intended to uphold a certain conclusion concerning the ultimate eternal source of change in the universe as a whole, and Aristotle has accordingly invested 'self-change' with no more meaning than is necessary for the discharge of this ulterior

function. I shall argue below, moreover, that attempts to precisify the concept as applied to organisms can only render it unfit for the larger task; thus it is left obscure not because it is difficult, but because if clarified it would be useless for the main argument, and the main argument provides its only *raison d'être* in the *Physics*. That argument we must now consider, in order to prove this claim.

(15) Let us begin with the opening words of Book VIII:

'Did change ever come into being, not having been before, and will it revert to non-being, so that then nothing will change: or is it something that always was and always will be, an immortal and unceasing property of things, like a kind of life of beings constituted by nature?' (250b11-15)

This, if a genuine question, is a courageous one to be asking at this stage, for it calls into question the fundamental starting point of many elaborate investigations already conducted. I mean the assumption that the nature of a substance is a principle of change. Possession of such principle, it was stated in II 1, is what distinguishes a natural substance from an artifact; possession of a principle for a specific type of change is what defines the specific type of a natural substance. Yet what stronger basis had Aristotle for these assumptions than everyday experience?⁸ It is one thing to observe that an inner principle of change distinguishes the natural substances with which we are familiar from the artifacts with which we are familiar; another to erect this into a necessary feature of natural substance as such. Aristotle may have been justified in assuming that no one would dispute the observation. But some argument is required to uphold the view that the observed difference is a definitive difference.

8. Cf. A. Mansion, *Introduction à la Physique Aristotélicienne*, p. 101.

It is not, for instance, self-evidently absurd to suppose that the natural world might for a time have existed, or one day exist, without any change at all taking place in it. Certain eminent thinkers had believed themselves to be talking sense when they stated that just such a changeless state of things had occurred or would occur in the history of the natural world. And if this is even possible, let alone true, then change and principles of change cannot be what defines natural substance, since according to such hypotheses, the world of nature, *i.e.* of natural substances, could exist without change. Now Aristotle never envisaged this problem in Book II. There he simply assumed that the natural world is as we have always found it to be (and cannot perhaps imagine it otherwise than being). He pronounced it absurd to ask for proof that nature (in the sense of an inner principle of change) exists:

'That nature exists it would be absurd to try to prove, for it is clear that many beings are like this [*i.e.* possessed of such principles]. And to prove what is obvious by means of what is not is the mark of someone who cannot distinguish what is knowable in itself from what is not.' (II 1, 193a3-6)

It never occurred to him that it might not be so absurd to ask for proof that nature, in this same sense, always has and always will be instantiated: *i.e.* that the existence of change-originating substances is not just an episode in the history of the world. But if it is possible that 'nature' in the sense of II 1 has application in some epochs but not in others, then 'nature' in the sense of II 1 cannot be taken as the fundamental starting point for inquiries into physical reality as such. This is the threat posed by the theories to which only now, in Book VIII, Aristotle gives his attention.

(16) Empedocles, for instance, had held (or so Aristotle tells us in VIII 1, 250b26 - 251a5) that the universe as a whole alternates between periods of stasis and periods of change. Aristotle interprets Empedocles as implying that these periods belong to a single continuous history. This is to say, when change takes over from stasis or *vice versa*, it is not as if a totally new universe has come into being. The alternation is a single pattern, not a succession of discrete universes. So on this view, this world, at present undergoing an age of change, has been and will be devoid of change. It makes no difference whether we are to suppose that there are special types of substance which get their chance of existence only in the epochs of stasis, or that throughout history the same types always exist, expressing their natures sometimes in change, sometimes in total non-change. Either way Aristotle's earlier starting point loses any claim to absolute status. But the alternating theory ascribed to Empedocles is only one example of a class of speculations threatening this claim. The threat is the same on any supposition that change is not continually present, whether the theory be that it alternates with non-change, or that non-change once and for all preceded or will supersede it.

(17) I shall not dwell on the question of the accuracy of Aristotle's account of Empedocles in VIII 1, nor on the question of whether he was fair in including the views of Anaxagoras and Plato among those which he has to combat. Nor shall I attempt a detailed account of his arguments that there never was nor will be a time without change. For the present purpose it is enough to say that by the end of VIII 1 he takes himself to have established this conclusion, thus answering the

initial question of Book VIII.⁹ His answer, moreover, makes no overt appeal to the original conception of natural substance. He does not formally assume this and then draw the conclusion as follows: 'Natural substance is by definition that which is possessed of an inner principle of change; there can be no natural world without natural substance; therefore change is an inherent feature of the natural world throughout its history.' It seems in short that in VIII 1-2 Aristotle proceeds as if the original conception were not available for building upon. This is the only indication that he intended the arguments of VIII 1-2 to support it. However, whether or not this was his intention, support is what they logically provide: not by entailing the concept's validity, but by contradicting a group of theories whose truth would undermine it.¹⁰

9. In fact, the position argued for in VIII 1 comprises two logically distinct theses which Aristotle does not separate: (i) At no time is the natural universe devoid of change; (ii) Time is infinite in both directions. If we assume that the natural universe exists only in and through time, then the II 1 doctrine of natural substance depends on the truth of (i) but not on that of (ii). For the doctrine requires that the existence of change as such should not have a beginning or end within the history of the natural universe, *i.e.* a beginning or end in time. But this does not entail that there might not be a sense in which time itself, and the history of the natural world, has a beginning and/or end. And if there were the possibility of a changeless state of things "before" or "after" time, this would not conflict with the view that natural substance is essentially characterised by change, since by the initial assumption what exists "beyond" time would not be a natural substance. (Thus Aristotle's doctrine of natural substance does not require him to argue, as he does in VIII 1, against the *Timaeus* view (taking it literally) that time was created. This is fortunate, since the argument rests on a fallacious inference from the truism that time cannot have a beginning or end in time, to the conclusion that it cannot in any sense be said to begin or end. Cf. G.E.M. Anscombe, 'Aristotle', in *Three Philosophers*, G.E.M. Anscombe and P.T. Geach, pp. 60-61.) However in the rest of this chapter I have followed Aristotle in his amalgamation of theses (i) and (ii): thus, *e.g.*, I use 'eternal change' to imply, as he does, a change that has no beginning or end in time and which is infinite because time is infinite.

10. However, VIII 3, 253b5-6 'ὁπόθεν γὰρ ὅτι ἡ φύσις ἀρχὴ τῆς

(18) In Chapter 2 Aristotle puts forward and answers what he takes to be the main objections to the doctrine that there always was and will be change. These all start from the same point, namely the undeniable fact of changes that begin and cease. The first objection states temporal finitude to be a necessary characteristic of all change; for all change, says the imaginary opponent, is from contrary to contrary, one of which marks the beginning, the other the end of the change, so that no change can continue indefinitely (252b10-12). Secondly, if, as Aristotle has argued, change never comes into being not having been before, how is it that there are beings, *e.g.* the inanimate substances, that begin to change, not having changed before? (12-16). And when we consider living things, such as ourselves, it is even more obvious that change can simply start, without the subject of change being already in a state of change. But if this can happen with the finite organised substances within nature, why should it not also be the case with the natural world as a whole, assuming this to be an organised entity logically analogous to those familiar organised substances which we call living things? The latter put themselves into motion from a state of rest, so that their self-change has a beginning in time: what reason then do we have for supposing that the universe as a whole did not begin to change, having been previously at rest? (17-28). This last objection seems irrelevant at this stage of the argument, for it assumes that Aristotle's position entails (a) that there is a change that belongs to the universe as a whole

κλυησέως' is not the remark of someone who sees any current need to defend the II 1 conception of nature. The tone of the preceding passage echoes that of II 1, 193a3-6 (quoted in paragraph (15)). But does 253b5-6 express the original unquestioned attitude of II 1; or does it rather reflect confidence newly gained through successfully defending the II 1 starting point?

considered as a single subject, and (b) that this change is everlasting. But neither Aristotle's arguments nor his conclusion in Chapter 1 logically commits him to either of these propositions. The logical truth-conditions of the conclusion that there never was nor will be a time without change may be presented in the form of an inclusive disjunction: Either (A) there never was nor will be a time when it is not the case that some change or other is occurring, or (B) there is some change such that there never was nor will be a time when it is not occurring. And the second disjunct, if it is true, may be true either because (B₁) there is an everlasting change of which the world as a whole is the subject, or because (B₂) there is an everlasting change whose subject is some being within the world. But the actual arguments of Chapter 1 make no reference to the disjunct (B), nor to (B₁) or (B₂). Starting (like his opponent in Chapter 2) from the fact of temporally finite change, Aristotle has argued in 1 that the conditions under which finite changes begin and cease involve prior and posterior changes. Obviously this argument does not depend on the assumption that any particular change is of other than finite duration. He also argued that the concept of a "time without change" is incoherent, on the ground that time has already (IV 11) been shown to be 'a sort of qualification of change' (251b27-28). But there is no suggestion in VIII 1 that there must be some single everlasting change of which time is the qualification.

(19) However, the last of the objections in VIII 2 is not as inconsequential as it may seem. The connection becomes apparent in Chapter 6, where Aristotle sets forth the presuppositions of the thesis that there is always change. One of the presuppositions is that there

should be at least one change that is individually everlasting. A temporally infinite succession of finite changes is possible only if some one change in the universe is of infinite duration and absolutely continuous. In other words, although the proposition that there is a change without beginning and end does not follow by logical necessity from the proposition that there never was nor will be a time without some change or other, the truth of the former proposition is for Aristotle a metaphysical necessity, given the truth of the latter. His reason for this we shall consider presently. Meanwhile, however, he is not yet ready to assert the former proposition, since to do so would be pointless in the context of replies to objections to the doctrine that there is never a time without change. The assertion could not function as an effective premiss in an argument supporting this doctrine against the objections, for the objector would simply refuse to accept it. Experience shows that there are changes that begin and cease; but experience does not and could not tell us that any single change goes on for ever. So in Chapter 2 Aristotle contents himself with pointing out that the possibility of an individually everlasting change is not ruled out. He answers the first objection by agreeing that change between contraries begins and ceases, but says that this is no reason why there should not also be a change (not between contraries) that is everlasting and eternally unbroken (252b29 - 253a1). He also (253a2) states that changes that have a beginning depend on prior changes in the environment; which implies that if there is some being (as for instance the universe as a whole, mentioned by the objector at 252b25 - 28) that has no environment, since nothing is outside it, its change, if it has one, must necessarily never have begun.

(20) However, in the context this implication is not stressed, and the main burden of Aristotle's reply in 2 consists in an expanded version of the point he has already propounded in Chapter 1: namely that when a finitely changing object begins to change, not having been in process of change before, the beginning of its change is not an absolute beginning of change in the sense that there never was, or need have been, any preceding change. A beginning of change in a particular substance necessarily implies that there has been some shift in the external conditions, which explains why the change that begins begins just when it does. And this, Aristotle makes clear (253a15 - 17), is as true for the self-changes of animate creatures as it is for the changes of lifeless matter. If it is assumed that a particular beginning of change in a particular substance is a beginning of change as such, and not merely of change in that particular substance, then of course it would be correct to argue, as the objector does at one point (252b12 - 16), that the existence of substances that begin and cease to change disproves the doctrine that there is never not change. But the assumption is false. With this it would seem that Aristotle has adequately defended his doctrine. Yet in his view there still remains a serious difficulty concerning the possibility of temporally finite changes, and, therefore, of the existence of substances whose nature is expressed in such changes. What this difficulty is, is not immediately clear, but the context shows that he sees it as springing from the view that change as such never begins nor ceases. The objector of Chapter 2, he implies, was right to regard the fact of finite change as a challenge to that view, and the challenge has not been fully met by Aristotle's answers in that chapter. Thus he begins 3 with these words:

'The starting point of our inquiry is a question that also relates to the problem already mentioned: What is that on account of which some things sometimes change and sometimes revert to a state of rest?' (3, 253a22 - 24)

(21) The sequence of thought between Chapters 2 and 3 is as obscure as that between 1 and parts of 2. Given the proof that temporally finite changes are necessarily preceded (and succeeded) by other changes, what more is needed to reconcile the fact of temporally finite particular changes with the doctrine that change as such is not temporally finite? How is it that Aristotle's answers in 2 fail to effect this reconciliation to everyone's satisfaction? The problem is not one of logical consistency but of metaphysical compossibility. It is not enough, he says, to explain the beginning of a finite change by reference to prior changes in the environment, for the alteration in the environment equally stands in need of explanation.

'It is not in the least absurd that something should change that has not been previously changing, given that the external cause of change is sometimes present, sometimes not. However, we have to consider how this is possible: I mean, how it is that one and the same potential agent of change should sometimes give rise to a change and sometimes not, in the same subject.' (2, 253a2 - 5)

This passage shows that what Aristotle finds puzzling is not just the fact of changes that begin and cease, but variation in general. The variation of a natural substance between change and non-change is one instance of this, while another is the variation in the substance's spatial relations to those external factors whose presence converts them from potential into actual causes of its change.

(22) But why should Aristotle find variation problematic? To him, apparently, the difficulty was so obviously a difficulty that he does not even pause to state what it is before proceeding straight to the task of solving it. This task takes him from the beginning of 3 to the end of 6, and it is only in 6, where the problem is presented as finally solved, that the modern reader can begin to see the nature of the puzzle. What emerges from 6 is that it is not so much the doctrine of everlasting change that casts doubt on the possibility of substances whose nature it is to vary between change and rest, but rather a certain postulate required to make sense of the truth of that doctrine. The postulate is that there exists at least one eternal and absolutely changeless cause on which the fact of everlasting change depends: and the difficulty is to see how such a cause could give rise to effects that are in any way variable. Let us consider these points in turn, first the postulate, then the resulting difficulty. Aristotle takes himself to have established not merely that there always was and will be change, but that this is necessarily so. The question now is how this necessary and everlasting fact of change is possible. To answer the question we must start from what we know beyond any doubt, and what we know is that there are temporally finite changes preceded and succeeded by other temporally finite changes. We do not at the outset know, prior to argument, that there is any single particular change that is individually everlasting. Hence to explain the everlastingness of change as such, we begin by assuming that what makes change as such everlasting is simply the fact that there is an everlasting succession of finite changes. We must, moreover, regard this succession as necessarily unbroken and everlasting, since otherwise we have no reason to accept that change as such is necessarily everlasting. But what can account for the necessary everlastingness

of the succession? Not, Aristotle implies, a succession of causes, each responsible for one of a succession of changes, for the succession of causes must be necessarily everlasting, if this is to be true of the succession of their effects; and the former succession will stand as much in need of explanation as the latter. Nor can the cause of the succession of changes be identified with any single substance that expresses its nature in temporally finite change, for just as change in such a substance gives way to rest, so every such substance passes away, one generation replacing another. Nor, finally, can the totality of such substances account for the infinite series, for this "totality" is an infinite multitude which does not all exist at once, so that it cannot be a cause even for a limited time, let alone throughout all time.

'The eternity and continuity of the succession cannot be accounted for by any one of them, nor by all together. For it is eternal and necessary, while the totality of them is infinite and they do not all exist at one time.' (258a29 - 32)

The cause must be some single being, not a succession of beings, and it must be eternally present throughout the series. Thus, Aristotle concludes, even if the immediate reason why change as such is everlasting is that there is an infinite succession of finitely changing and transiently existing substances, each giving rise to changes in itself and in other things, still

'it is nonetheless true that there is something that comprehends (περιέχει) them, being other than any of them, and that this is the cause of some things existing while others cease to exist, and of the continuity of change (τῆς συνεχοῦς μεταβολῆς).'

(259a3 - 5)

(23) Everlasting change then depends on an eternal cause, or causes:¹¹ for Aristotle's argument does not exclude the possibility of a plurality as such, but only of a successive plurality. In addition to being eternal, the cause or causes must, he assumes, be absolutely changeless. Aristotle does not make explicit the reason for this assumption. In VIII 5 he argues for the point which we have already considered (*v.s.* Chapter IV, paragraphs (22) ff.), *viz.* that causing change is not itself a kind of change of which the cause is subject. But the fact that the eternal cause, insofar as it functions as cause, neither changes nor needs to be able to change, does not entail that it is in all respects changeless, any more than the fact that building is neither a change nor a potentiality for change in the builder entails that the man who builds is in every respect changeless. However, the vital difference between the two cases, although Aristotle does not spell it out, is that the changes effected by building are of limited duration and interruptible, so that there is no contradiction in supposing that the individual who builds might change in ways that would terminate the building activity; whereas the eternal cause is postulated as the cause of an eternal effect, which rules out its liability to any change that could suspend its activity as a cause. And since all that we know of this postulated cause is the function for which it was postulated, *viz.* to be the cause of everlasting change, its absolute unchangeability in the actual fulfilment of this function implies that for our knowledge it must figure as absolutely unchangeable *simpliciter*. Now it is this that creates the problem for varying substances and their varying conditions. For how can variation result

11. Nothing in this discussion hangs on whether the references in VIII 6 to a possible plurality of eternal changeless causes are late insertions.

from the eternally unvarying causation of such a cause? If such a cause can be supposed to produce change at all, the change must be a process whose properties mirror its own as far as it is possible for change to mirror the changeless. The change, then will be an eternal process which is no more made up of successive finite processes than its cause is made up of successive transient substances. Thus it would seem that the effect of the eternal cause or causes can only be one or more than one individually eternal changes. Now unless there is some escape from this reasoning, Aristotle's argument up to this point could legitimately be converted into a proof that the succession of finite changes, and of substances whose nature is expressed in finite change, is not infinite. For if the succession can be supposed infinite only on the assumption of an eternally unchanging cause, and if such a cause can cause only change that is individually unbroken, then the concept of infinite succession is self-invalidating; for the infinity of the succession must be explained by an assumption that rules out the possibility of succession. So that if there is succession of changes, which no one can deny, the succession itself must be of finite duration, which is as much as to say that there has been or will be a time when there is no finite change, and therefore no beings such as those which for Aristotle are *par excellence* examples of natural substance. But if the existence of such beings is localised to certain temporal pockets of the world's history, it is sheer parochialism to imagine that philosophical inquiry into the structure of their characteristic changes can lead to universal conclusions about natural substance or nature as such.

(24) Aristotle's answer is skilful. He postulates a *tertium quid* causally intermediate between the eternal changeless cause and the varying transient effects, which participates sufficiently in the characteristics of each to be rationally conceivable as the effect of the former and cause of the latter. This connecting link is a process of change which resembles the changeless cause in being absolutely unvarying in its form and unbroken in its duration, while at the same time resembling variegated change in that it too is a change. Since there can be no change without a changing subject, and since a single unbroken change presupposes a single individual subject persisting throughout, it follows that there must be at least one eternally existing entity other than the changeless cause, *viz.* the subject of the change that this cause brings about. Thus at 6, 259b32 - 260a5, Aristotle writes:

'If there exists something such as we have said, a cause of change which is itself changeless and eternal, that which is primarily changed by it must also be eternal. This [*sc.* the conclusion that the primary patient cannot be any transiently existing and transiently changing substance] is also clear from the fact that otherwise there would be no coming into being and passing away and variation (μεταβολή) of other things, unless there is a cause of change which is itself a subject of change. For the changeless will always cause change in the same way, the change being [*sc.* numerically] one, since it does not itself vary in its relations to what it changes.

Whereas a changing entity, even if its change is single and eternal, may be supposed to stand in different relations at different times to other beings, and so to be able to affect them variously. Aristotle's next sentence, according to the generally accepted text, shows that he does not regard variation as the immediate effect of eternal change due immediately to the changeless; instead he separates variation from the changeless by a series of several intermediate eternal changes. (260a5 - 10) The details of the implied cosmology are not made clear in

the *Physics*, and nor need they be for Aristotle's present purpose, which is to work out the bare metaphysical basis of an eternal sequence of finitely changing substances. Logically, this reasoning does not commit Aristotle to identifying the eternal change whose existence has been proved *a priori* with any process or processes known to us through observation. However, both he and his audience were already disposed to regard the motions of the heavens as eternal, so that heavenly bodies are the natural candidates for him to assign to the rôle which he has shown must, as a matter of metaphysical necessity, be filled by something or other. That assignment once made, questions concerning the number and causal order of distinct eternal (celestial) motions and moving bodies become problems for science, to be settled by whatever hypotheses best explain the astronomical data.¹²

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12. Paragraphs (22) - (24) are an exposition of VIII 6, 258b26 - 259a6 and 259b32 - 260a19. These two passages together yield the following argument (let us call it A): (i) Given that the sequence of finite changes is eternal, there must be an eternal changeless cause; (ii) given that there is an eternal changeless cause, there must be an eternal change (and an eternal subject of this change) by the mediation of which the changeless cause operates and which connects it with finite change. However, Aristotle also argues (B): (i) Given that change as such is eternal, there must be some single unbroken eternal change; (ii) given that there is a single unbroken eternal change, there must be an eternal subject for this change and an eternal cause, since otherwise it would not be unbroken (VIII 6, 259a13 - 20; step B (ii) is elaborated in VIII 10, 267a21 - 267b6). In B the pattern of thought neatly matches the relations between the objects, the unbroken eternal change acting as middle term in the argument just as it is causally intermediate in reality. In A, the changeless cause is the logical middle term. I have preferred to expound A rather than B, partly because Aristotle gives rather more space to the two parts of A, but mainly because B is an inferior argument, offering no plausible account of the inference in B (i) from the eternity of change as such to a single eternal change. Noting this *non sequitur*, Ross and Solmsen hold that Aristotle's 'certainty that [some single unbroken eternal] change exists arises from a reason which has never been mentioned in the argument' (Ross, *Aristotle's Physics*, pp. 91 - 92). According to Ross,

(25) To establish the metaphysical position outlined above, Aristotle needs to have reasoned his way past a serious difficulty, and it is here that his argument relies crucially on the concept of self-change. But before considering this, I want to examine what seems to me a spurious problem raised in connection with the position itself by Professor Solmsen. Solmsen claims to find an inconsistency between the doctrine of an eternal ultimate cause of change in the universe and the II 1 conception of natural substances as containing each within itself a principle of change. Describing the inference to the eternal ultimate cause as 'a Platonic line of thought', Solmsen writes:

'Aristotle has so faithfully preserved the Platonic line of thought - and how could he help it if he wished to find the first mover? - that he does grave harm to one of his own new doctrines. As we know, Book II defines nature as "a source of movement" and natural objects as "having a source of movement in themselves". What in Plato was reserved for soul has in Aristotle become the property of all nature. Yet that which has the source of movement in itself should certainly be able to initiate its own movement and not be in need of receiving the impulse from a remote principle. Evidently in Book VIII Aristotle is developing a legacy of the Platonic world soul which conflicts with his own doctrine that all natural entities have their source and principle of movement in themselves.'¹³

We have no wish to dispute Professor Solmsen's learned account of the historical development of Aristotle's position in *Physics* VIII from certain Platonic doctrines, but only to consider whether, as Solmsen holds, the development conflicts with Aristotle's own concept of the

the 'unmentioned reason' is 'observation [*sic*] of the never-ceasing rotation of the heavens' (*ibid.*), while in Solmsen's view (*Aristotle's System*, pp. 225-228) it is the influence of Platonic cosmology. No doubt observation and inherited outlooks play a part, but the text of VIII 6 also provides an explicit argument, namely A, for the alleged *non sequitur*. Both commentators overlook this, perhaps because B is more prominent than A in *Metaphysics* A.

13. *Aristotle's System*, p. 232. See also pp. 233-234, 100-102, and 'Platonic Influences' (*loc. cit.*) pp. 228-229.

nature of a natural substance. The seriousness of this conflict (supposing Solmsen to be right) depends partly on the general light in which we regard Book VIII. From any point of view, the most important conclusions of VIII are by Solmsen's account inconsistent with all those earlier writings that take the II 1 concept of nature as an essential starting point. On the other hand, Book VIII itself could be regarded as broadly speaking self-coherent, if we were to interpret it as a free-standing inquiry which neither questions nor seeks to justify that earlier concept. But if, as I have suggested, VIII can be read as an attempt to defend the latter, (a) by showing that the existence of natural substance as defined in II 1 is indeed an eternal feature of the universe (thus justifying the title of 'substance' for objects falling under the definition), and (b) by explaining how this is possible, then if Solmsen's criticism is sound, Book VIII is not only rampantly at odds with itself but provides all the materials for a *reductio ad absurdum* of Aristotle's original concept of nature.

(26) It is because of the gravity of these implications that Solmsen's criticism mainly merits attention, rather than through any great plausibility of its own. It arises partly from its author's apparent inability to see how something could coherently be said both to change by its own nature and to depend on something else for the realisation of this change; and partly on his belief that in certain passages of VIII Aristotle actually does what to Solmsen is the only consistent thing for him to do, namely sets aside his earlier theory of nature. Certainly, if at any point Aristotle did this, his doing so would be evidence that at moments anyway he sensed some inconsistency

between that theory and the newly established position of VIII. But in fact there is nothing in VIII to suggest that he is troubled in the way in which Solmsen undoubtedly thinks he ought to be. Solmsen is presumably leaning on his own assumption that at 4, 254b14-15 Aristotle makes 'self-change' synonymous with 'natural change' (*v.s.* paragraph (2), footnote 1). If this were so it would entail that Aristotle is no longer prepared to ascribe nature to inanimate substances. But there is nothing to support the assumption of synonymy, as we saw (*ibid.*). Solmsen also seems to regard Aristotle's insistence on a distinction between changer and changed in the self-changer as entailing that nothing can be properly described as 'changed by itself': which on the synonymy assumption would imply that nothing can be said to 'change by its own nature'. Finally (although this is not made clear), Solmsen also seems to draw support from those passages in Chapters 2 and 6 where Aristotle argues that all sublunary changes, even those of living creatures, are causally dependent on prior changes in the environment. It is true that Aristotle paid virtually no attention to this aspect of change when first expounding the doctrine of nature in Book II, and brings it now into focus only when he needs it to help support the thesis that there can never have been a time without some change or other. But there is no need to interpret this shift of interest as a withdrawal from the earlier doctrine, which, as we have stressed from the first, is entirely consistent with the view (which no sane person could deny) that natural substances are not absolutely self-sufficient sources of their natural changes. A cursory glance at 6, 260a1-10, where Aristotle speaks of an eternally changing body as the proximate changer of sublunary substances, being responsible by its activity for their coming to be and passing away and their variation of behaviour, might cause us to fear for the earlier

doctrine of nature: but only as long as we fail to note that Aristotle has already in 4 committed himself to using the active and passive of the transitive verb 'κινεῖν' in a blanket sense to cover a number of types of causal dependence, some of which have nothing to do with immediate determination of the form of the dependent change. If a releaser from hindrance can be called a 'changer', then why not also a heavenly body such as the sun whose eternal rotation through positions at differing distances from the earth ensures the continual rotation of seasons that condition the varying activity of sublunary substances? (See *De Gen. et Corr.*, II 10.) And why should the sun, any more than the releaser, be thought to usurp the change-forming function earlier assigned to the natures of these substances, or rather, to the substances themselves considered as being of the kinds they are? But if natural changes are compatible with dependence on a proximate eternal cause such as the sun, there is no reason why they should not also be compatible with dependence on the ultimate changeless cause which sustains, *via* however many causal stages, the sun's eternal motion and the eternal sequence of its finite effects.¹⁴

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14. Solmsen describes Aristotle in *Physics* VIII as maintaining 'the causal dependence, by way of *chain transmission* [my italics], of all other movements and changes in the world on [the] *primum mobile*', *Platonic Influences*, p. 216; cf. *Aristotle's System*, p. 248. This suggests a universal mechanistic determination which indeed would rule out 'change from a thing's own nature' as explained in II 1. But while Aristotle in VIII maintains universal dependence of all changes on the ultimate eternal rotation, he is aware that dependence takes other forms than the reception of transmitted motion. (The generator and liberator are agents of natural inanimate movement, but by making possible, not by transmitting.) Since 'transmission' literally implies that the self-same change is passed on to the patient, the theory of VIII not only does not entail but actually rules out dependence-by-transmission of all changes on the motion of the *primum mobile*, since if this eternal motion were passed on, what is passed on would be eternal, and there could result no finite changes. It is true that in VIII 5 Aristotle examines causal series in which the dependent changes might not unreasonably be described as 'transmitted': the man pushes the stick

Solmsen, it seems clear, has failed to take full account of Aristotle's view that the ultimate changeless cause works only *via* an eternally unvarying change. Perhaps it is Solmsen's preoccupation with the Platonic antecedents of this latter concept that causes him to overlook the protection that it gives to the Aristotelian doctrine of nature. If, as Aristotle insists, the ultimate cause must manifest itself in an eternal change, this is because it cannot manifest itself in finite sublunary changes,¹⁵ but (at most, at their level) in the fact that the series of such changes is endless. But this means that the concept of the ultimate cause cannot be regarded as competing for the position occupied by the concept of 'nature' in Book II. For the nature of a sublunary natural substance (as defined in II 1) does what the ultimate cause (as demonstrated in VIII 6) could not conceivably do, according to Aristotle's theory: namely manifest itself in transitory events; while the ultimate cause does what sublunary natures individually and collectively could not conceivably do, namely ensure the necessary eternal continuity of the series of substances in

which pushes the stone, etc. Here the dependent changes are counter-natural to their subjects. Aristotle's point is that every such series starts with a 'self-change', of which a human voluntary movement would be an example. Thus, *e.g.*, if a particular eternal rotation is simply the mechanical effect of the rotation of an ulterior body, still the series must originate with a "self-rotation" (involving an unchanging agent and rotating patient). (For Aristotle's application of the 'ἀνάγκη στήναι' principle to such a series of eternal motions, see VIII 10, 267a 21-267b1.) But there is no evidence that Aristotle thinks that all changes stand to the eternal self-motion in the same type of dependence relation; *i.e.* that all changes, eternal and finite, are to this self-motion as its mechanically determined dependents. If he did think this, how could he take the man's voluntary movement as an example of self-change? This sublunary instance differs from the eternal self-change in being subject to possible hindrance from without, but resembles it in not being a 'transmitted' change.

15. Cf. Zeller, *Aristotle and the Earlier Peripatetics*, vol. I, p. 421.

which the natures are realised.¹⁶

(27) The real conceptual difficulty besetting Aristotle's position is this. He has argued (a) that the eternity of the series presupposes an eternal changeless cause, and (b) that its variegation presupposes a cause in process of change. He has then (c) related these two presupposed entities by causally subordinating the second to the first, and this move has led him to postulate (d) that the change in the second is such as to reflect, as far as possible, the properties of the first, *i.e.* is an eternally unvarying change. Thus, as he says at 3, 253a28-32, the sequence of beings that are sometimes changing and sometimes at rest can be explained only on the assumption that not everything is of this kind, but that something is always changing and something always unchanging. But now why should we suppose that the always unchanging and the always changing are different beings? Why, in other words, should we not accept the arguments (a) and (b) above, but put them together so as to draw a different conclusion from Aristotle's, *viz.* that the ultimate cause is a unitary being comprising within itself both eternal change and eternal changelessness, in that it everlastingly changes with a changeless change? This is in fact the true description of the entity which for Aristotle stands to the ultimate cause as its immediate patient; and our question now is why this entity needs to be regarded as a patient at all, rather than as

16. For further discussion see Appendix to Chapter V. The position argued in paragraph (26) seems to bear out the contention of W. Wieland (*Die aristotelische Physik*, ch. 16, translated as 'The Problem of Teleology' in *Articles on Aristotle*, vol. I, edd. Barnes, Schofield and Sorabji), that Aristotle does not subscribe to a 'universal cosmic teleology'. However, Wieland does not explain this phrase sufficiently to permit an exact assessment of the relation between his thesis and the position here maintained.

the ultimate cause itself. For Aristotle, by his own reasoning, is anyway forced to endow it with eternal change and unchangingness (*i.e.* continuity and uniformity of change); and eternal change and unchangingness are the two properties needed to account for the eternal succession of transitory changes. It seems as if in postulating distinct beings as bearers of the two properties, Aristotle is pointlessly reifying the properties themselves. But if we refuse to allow him this move, he cannot get beyond the eternally changing entity itself; and since (i) its demonstrable properties account for the sequence of finite changes, and (ii) reasoning from these premisses can go no further, this entity may reasonably be termed the ultimate source of all change.¹⁷ And since, as Aristotle will argue extensively in VIII 7-9, locomotion is the one type of change that could continue eternally, it would follow that the ultimate cause is some kind of corporeal object moving through space.

(28) If an opponent put this point to Aristotle no doubt he would reply that even if an eternal body in eternal circular motion is adequate to account for the effects which it is postulated to explain, still it is not adequate to account for its own motion: this change like any other must depend on an agent, and this agent must be in some sense distinct from the moving body itself, so that it is the agent, not the moving body that is the true ultimate cause. But the opponent

17. Philoponus *ad* 259b32, Vitelli 893, 6 ff., writes as if someone had suggested that an eternally moving body is a sufficient cause of the unbroken succession of generated things: '... ἐπειδὴ τῆς αἰδώς τῶν γενητῶν διαδοχῆς ἀνάγκη εἶναι ἓν τι καὶ αἰδῶν αἴτιον, τοῦτο δὲ ὁ μὲν ὥσως ἂν εἴποι κινούμενον εἶναι ὁ δὲ ἀκίνητον, διὰ τοῦτο δείκνυσιν ὅτι εἴτε κινούμενον εἴη τοῦτο τὸ αἰδῶν, ἀνάγκη καὶ ἀκίνητον εἶναι τι αἰδῶν ἀφ' οὗ τὸ κινούμενον αἰδώς κινεῖται ...'

could justly complain that so far nothing has been said to block the following move: Why should we not conceive of the eternal body as analogous to earth and fire? Just as the natures of these substances are natures for tracing out certain characteristic paths through space, so, let us say, it is the nature of the former to trace out (for its parts, not for its total bulk, since it rotates always about the same centre) a circular path. This in fact is precisely the position for which Aristotle himself argues in *De Caelo* I 2-3, and he also says in that book that there is nothing superior ('κρείττον') to the eternal body that could act as agent of its change (I 9, 279a33-34).¹⁸ We may spell out the position as follows: if it is the nature of the eternal body to rotate, then the rotation does not require an agent distinct from the subject of motion itself.¹⁹ For firstly, if the

18. This common interpretation of the passage is disputed by H. Cherniss, *Aristotle's Criticism of Plato, etc.*, pp. 587-588. Solmsen's rebuttal of Cherniss (*Aristotle's System*, p. 308, note 30) is in my view unanswerable. But even if Cherniss were right about Aristotle's meaning, this would not affect the logical point that a distinct agent is redundant if the eternal body is of a nature to rotate. See Appendix to Chapter V.

19. A full treatment of the *De Caelo* I position would highlight the way in which two contrary tendencies contribute to the same conclusion, *viz.* that there is no distinct mover of the rotating body (although, notoriously, this is not a conclusion to which Aristotle consistently seems to keep in *De Caelo* as a whole). Firstly, the comparison with the sublunary simple bodies, and especially the attribution of a nature specifiable like theirs in purely locomotory terms, makes of the heavenly rotation a thoroughly natural fact, representable by physical concepts and no more dependent than ordinary sublunary motions on a mysterious transnatural agency (*cf.* Solmsen, 'Platonic Influences', *loc. cit.* pp. 226-227). But secondly, the eternity, uniformity and perfect circularity of the heavenly motion manifest the divinity of the moving subject, and now it is this divinity that excludes dependence on an agent (*cf.* below, paragraphs (47) - (49)). The contrast between these two lines of thought is extreme if the *De Caelo* I 2 comparison with the sublunary simple bodies is taken as logically committing Aristotle to the view that the "first body" is like them inanimate. However this would follow only on the assumption that being animate involves a distinct internal agent of natural change. This is

relation of this body to its own rotation is comparable to that of fire to motion upward, then the eternal body's nature cannot be regarded as an agent of its change. The nature of fire, as Aristotle makes clear in *Physics* VIII 4, is not the agent of fire's rising: this follows from his refusing to class fire etc. as self-changers, and from his statement that the inner principle in such substances is a principle not of causing the natural change, but of suffering it. The only agents of fire's natural motion that he recognises are external substances that have made the motion possible. This brings us to the second point, which is that the eternally rotating body cannot be supposed to stand to any other substances in the relations in which fire stands to the external agents (so called) of its natural action. For the body must be eternal, hence ungenerated, and since its motion is not only continuous but necessarily so (for it could not otherwise account for the necessarily continuing succession of finite changes), it is immune to any possibility of hindrance, hence owes nothing to a liberator. In short, if fire were an ungenerated substance and so powerful that nothing could hinder its natural motion, then fire too would be without an agent: which does not entail that fire would lack motion, but rather the opposite, *i.e.* that its nature to move would have absolutely free play. And so, for all that has been shown to the contrary, it may be with the eternally rotating body, or bodies. Solmsen after all was right to suspect possible

the position of *Physics* VIII, being a necessary premiss for proving the eternal changeless cause (see paragraph (29)). But in *De Caelo* Aristotle does not set out to prove such a cause (although sometimes seeming to assert its existence), and therefore 'soul' there for him need not imply a distinct agent of change. Thus the *De Caelo* "first body", even if ensouled (as he says it is at II 2, 285a30), could still resemble the sublunary inanimate ones in being dynamically simple.

inconsistency between Aristotle's doctrine of nature as a principle of change, and the position of *Physics* Book VIII, although wrong in locating the trouble. The VIII 6 theory of the changeless first cause of change does not, as Solmsen thought, contradict the earlier picture of sublunary substances as endowed with natures; but it does make problematic any extension of the concepts of nature and natural change to cover the eternal body and its characteristic motion.²⁰

(29) In *Physics* VIII, however, Aristotle does not hesitate to claim a distinct agent for the primary eternal motion. Indeed he proceeds as if unaware of the possibility of an account such as that suggested in the last paragraph, or as if it needed no refutation. Thus he is viewing the topic from a conceptual basis which keeps this problem out of sight altogether, or else solves it without ado. Either way, that basis is provided by the notion of self-change, which comes to the fore in 4 and 5, *i.e.* between the first and last stages of the inquiry that opens in 3 with the question of how an eternity of finite change is possible, and ends in 6 by stating that it is possible only on the assumption of an eternal motion and a changeless source of that motion. To reach the latter position by rational steps, Aristotle needs a concept that meets the following three requirements: (a) it comprises within itself the notion of something changing, and of something distinct although not physically distinct that is the cause of change; (b) it can be illustrated and therefore proved meaningful by instances in the sublunary world; (c) it can be shown to be necessarily instantiated on the level of the primary eternal

20. See Appendix to Chapter V.

motion. The notion of "self-change" in *Physics* VIII meets all these requirements, and indeed could have been constructed purely with this end in view, since it has virtually no content beyond what is necessary to fulfil them. Of the three, we have already given some consideration to (a) and (b). Let us therefore turn to Aristotle's efforts to meet (c). To do this, we must follow his manoeuvres with "self-change" in some detail.

(30) When he first introduces the concept in Chapter 4, it is in order to help sustain that chapter's conclusion, that whatever changes is changed by something (if not by something other, then by itself). From this Aristotle doubtless hopes to be able to deduce that even what eternally moves is moved by something. But his ground is weak, for the range of cases on which he bases the universal proposition includes only sublunary substances, and by what right do we extrapolate from these to the eternal case? Moreover, two of the three classes of sublunary change taken as evidence for the proposition that every change has an agent are of no evidential value whatever as regards the eternal change. We have seen that the eternal motion, unlike the natural motions of fire and earth etc., cannot depend upon a generator or a liberator of the moving substance (*v.s.* paragraph (28)). Nor can the eternal motion be attributed to an enforcing agent. The enforcement would be eternal, and to Aristotle there could hardly be an idea more absurd than that of eternal enforcement or the eternal repression of a nature. Thus the only sublunary fact about agency that provides any ground for inferring to an agent for the eternal change, is the fact that there is a third class of agent-dependent sublunary changes: namely those changes which are "by" the substance

itself, or self-changes. But many sublunary changes are not self-changes; so that the whole range of sublunary cases provides dubious support for Aristotle's conclusion concerning the eternal case. He may be justified in asserting that if the eternal change is "by something" then it is more akin to sublunary change "by self" than to either of the other types. But he does not succeed in making a cogent argument for the antecedent of this hypothetical.

(31) Aristotle next (Chapter 5) tries to show that in every case where a thing is changed by something other than itself, the source of the change can be traced back through one or many causal stages to a self-changing agent. Every causal series in which one thing changes another starts from self-change. He puts this forward as a general thesis, but its main effect is to establish that if in particular there is such a thing as an eternal change, this too either is or depends ultimately upon self-change. And the self-changer concerned (which must itself be eternal, since otherwise its effects could not be) can then be analysed into a changer (the Prime Mover) and a distinct changed (the *primum mobile*). In this way Aristotle blocks off in advance any attempt to merge the two entities metaphysically demonstrated in 6, the cause of eternal change, and the body that eternally changes. He rests his case in 5 on the proposition, there taken as axiomatic, that there is a causally first changer in every causal series of changes.²¹ His examples show that by 'changer' here, he means 'agent that currently determines the form of change', and not 'condition that makes possible the change', nor 'agent that brought

21. For an attempt to prove this, see *Physics* VII 1.

about a condition making possible the change'. Thus when a man moves a stick which moves something else, and when the wind pushes a stone which in turn knocks something over, the first changer is the man or the wind. The proposition that there must in this sense always be a causally first changer follows directly from the II 1 doctrine of nature, for if everything owed its behaviour to an external determining cause, there would be no natural change. Thus within the terms of Aristotle's system, the proposition is indisputable and legitimately functions as an axiom. But what is questionable is his identification in 5 of the causally first changer with a self-changer. The human agent does of course qualify for this title according to the division made in Chapter 4, but not the wind, which for Aristotle is only air in motion, a simple inanimate body. Thus, as regards the eternal case, he may reasonably hold that there cannot be an infinite causal series of eternal motions; but this does not automatically entitle him to conclude that at the head of the series there stands an entity that changes itself in some sense analogous to that in which sublunary living things are supposed to. For it would be just as reasonable to conclude that the series starts with a naturally-changing eternal entity similar to the wind, *i.e.* a simple, through and through physical, substance.

(32) However, Aristotle now brings into play the earlier conclusion that whatever changes is changed by something, either itself or something else. In the examples given, the first changer causes change only by itself changing (intransitive), and since *ex hypothesi* this change is not due to anything other, it must be due to itself (5, 256a19 - 21). By this reasoning even the wind must count as a self-

changer: an unwelcome consequence,²² not only because it contradicts the division of substances in 4, but because it so devalues the concept of self-change as to make it hardly worth arguing for an eternal self-changer as the source of all change. For on this extension of the concept, even if the eternal source can now be shown to be a self-changer, this would give no ground for supposing that its change is not on the same logical level as those of the sublunary simple bodies, being dictated only by the sheer corporeal nature of the changing body, and not by any principle remotely comparable with life, soul, spirit or mind. And even if Aristotle might be willing under pressure to waive (surely to the detriment of scientific investigation) his sublunary division into animate and inanimate, treating fire and earth etc. in animistic terms, this would not much strengthen his position in VIII: at least not if his motive is to uphold the dignity of the supreme cause. The souls of earth and fire would rank pretty low on any scale of psychic levels, lower perhaps even than those of plants. Thus there would not be much to choose between a theory by which the ultimate cause might be an inanimate body inanimately

22. However, at 256a22 ff. Aristotle may be deliberately treating the wind as a self-changer for the sake of his current argument. The question turns on the meaning of the conveniently ambiguous 'αὐτῷ' in 'ἢ γὰρ αὐτῷ κινεῖ τὸ κινουὺν ἢ ἄλλῳ'. Here 'αὐτῷ κινεῖ' stands for the relation between the first changer in the series and its proximate changed. Now on the one hand he glosses the above sentence with 'οἷον ἄνθρωπος ἢ αὐτὸς ἢ τῇ βακτηρίᾳ, καὶ ὁ ἄνεμος κατέβαλεν αὐτὸς ἢ ὁ λίθος ὃν ἔωσεν'. On this explanation, 'αὐτῷ κινεῖ' seems only to deny an intermediate or instrumental link, hence can in this sense apply to any causally first changer whether or not this has the logical complexity that would justify calling it 'self-changer'. But on the other hand, the contrast 'ἢ αὐτῷ κινεῖ ... ἢ ἄλλῳ' suggests that the changer can be its own instrument or intermediate link, which implies logical complexity, a distinction between the changer's body with which it causes change in something else, and an internal agent-element whose instrument this is.

rotating, and one by which it might be something whose closest sublunary analogues are souls of the most rudimentary kind.²³

(33) When in *Physics* VIII Aristotle takes the natural changes of organic creatures as his model for the ultimate eternal change, he does so for the purely negative reason that the only alternative sublunary models would be even less suitable, and not because he sees more than the vaguest resemblance between the eternal case and that of an organism. Indeed the list of criteria in 4 by which he distinguishes sublunary self-changers from sublunary non-self-changers makes it doubtful whether there could be any resemblance. The body of the eternal self-changer is a physical sphere without internal physical diversification: this simplicity is a condition of its being absolutely indestructible. Since the eternal motion is single and simple and takes place in it as a whole, the body has no need of variegated parts with which to function. Nor can it stop and start or change in different ways.²⁴ Nor can it be regarded as alive or

23. The Academic audience (and possibly Aristotle himself) may have been deceived into accepting the proposition that every causal series of changes starts from a self-changer by its verbal similarity to Plato's position in *Phaedrus* 245 C ff. and *Laws* X 894 B ff. Since for Plato a self-changer is not a complex of distinct agent and patient, but an entity that changes of itself, the axiom forbidding an infinite causal regress of changes is on its own sufficient to prove the existence of a self-changer in Plato's sense - but not in Aristotle's. Whereas for Plato, self-change is the defining property of soul, in Aristotle's system the beings that most closely approximate to Platonic self-changers are, paradoxically, the simple inanimate bodies, because they (a) change of themselves, and (b) are not internally differentiable into agent and patient.

24. Aquinas (*Comm. on Phys. VIII*, Lectio VII, 7) sees the inapplicability of this criterion to the eternal case, but is comforted by noting that Aristotle does not say in VIII 4 that a self-changer must be capable of different externally undetermined changes, but only that it is unreasonable (ἄλογον) that it should not be (255a10-11).

ensouled in the sense in which this characteristic is displayed in one or more levels of biological functioning.²⁵ It may be for this reason that Aristotle makes possession of soul in 4 a criterion of sublunary self-change, but stops short of laying it down as a defining characteristic, and also of explicitly identifying the soul with the internal agent. A definite commitment on either of these points might call into question his right to extend the concept of self-change to the eternal case. And in general, the less he commits himself regarding the import of 'self-change' as applied to sublunary substances, the better for his main argument. Even doubts as to the concept's coherence are better ignored, for two reasons. In the first place, Aristotle cannot afford to furnish critics with grounds for rejecting 'self-change' as a predicate of sublunary substances, for if it is meaningless in this connection, what reason have we to suppose it meaningful in any other? And how could we understand its meaning if there is nothing in the sublunary world of our experience to illustrate it? Secondly, even if the problems raised earlier concerning sublunary self-change can be solved, this is worse than useless for Aristotle's main argument, if, as seems likely, the solutions rest on features present only in the sublunary cases, not in the eternal one.

(34) For in fact there are several ways in which a case could be made for distinguishing an agent- and a patient-element in organisms

25. Of course it may be suggested, and has been, that the mover of the eternal body is a type of soul not exemplified by any sublunary creature, and this may have been Aristotle's position at a certain stage. But there is no sign of this in *Physics* VIII, and in 9, 265b32-33 he speaks of those who 'make soul the cause of change' (*i.e.* the Platonists) as one who does not count himself among them. Cf. Solmsen, *Aristotle's System*, pp. 242-245.

along lines consistent with the unity of the organic substance. We might for instance take a cue from Aristotle's remark in Chapter 6 that the only type of change that organisms originate of themselves is locomotion. This entails that changes of quality, such as temperature, and growth insofar as it depends on qualitative change, are determined as to their character by external conditions. Such changes, then, are only indirectly due to the organism itself, arising when its externally undetermined locomotion, whether of whole or parts, brings it into contact with the external determinants of qualitative change. Thus at the moment when the actual heating, for instance, takes place, the organism or some part of it is the passive subject of this change, as much so as if it were an inanimate substance. In taking this point of view, we are identifying "the change" with the actual emergence of the new property (*cf.* Chapter III, paragraph (4)). But alternatively we might include under "the change" (the becoming hot) the process leading up to the emergence. Since this process consists in an externally undetermined locomotion, the creature is not passive with respect to "the change" in this sense, any more than the physician who applies a poultice to his own body. Thus the organism could be described as bringing about for itself the situation in which it or some part of it is passive with respect to the immediate cause of heat, and so it may be said to change itself. Obviously no such analysis could be applied to the eternal self-change, consisting as it does in a single uniform motion.

(35) Again, the natural changes of organisms, unlike those of Aristotle's simple bodies, involve two different aspects which it is not unreasonable to regard as active and passive. When fire flies

upwards and earth falls, the unforced motion is what it is the nature of each to realise, and a description of the motion gives a complete specification of the nature: it is the nature of the substance to move like this whenever there is no hindrance. But when a living thing displays unenforced change of a given description, this description does not exhaust the account that might be given of the nature of the substance, since there are many forms of unenforced behaviour which the same individual realises on different occasions, and the mere fact that a given behaviour-sequence would meet with no external impediment is not sufficient for its actually coming about. Different situations trigger different types of behaviour, as does the same situation at different stages of the creature's development. It might seem that a description of the whole range of these unenforced changes might be adequate to characterise the nature of the individual, so that this case differs from that of lifeless substances only in complexity. But even assuming it possible to arrive at a complete description of everything that the organism would unenforcedly do under different circumstances, it would be wrong to say that all this is what it is the organism's nature to do, leaving the matter at that; for this statement does not exclude what for Aristotle is the metaphysical impossibility of a substance endowed with a plurality of natures each coming into play under different circumstances. It is not enough to say that the substance is of a sort to do (if unhindered) A under conditions X, B under conditions Y, etc., for to say that it is of a sort at all already implies some underlying or overall unity of nature, which can be expressed only in a corresponding unity of behaviour, and this is not brought out by such a list of hypothetical behaviors. In short, Aristotle's theory of nature presupposes that there is some single description true of each item on such a list.

And if we ask what this one description could be which the individual satisfies in and through all its various unenforced changes, the answer, it seems, can only refer to the maintenance of the life-form of which this individual is an instance. This is what it is the nature of this creature to do, being an activity that takes (as we should expect) quite different shapes under different conditions.

(36) Thus for organisms, by contrast with inorganic substances, there is a conceptual gap between the description of the activity that defines their nature, and the descriptions of the specific, immediately identifiable, unenforced changes in which they engage. We may say that the former activity stands to these changes as form to matter, since it is realised through them. The activity can also be said to be the cause of any particular specific unenforced change that occurs. The claim that causal dependence runs in this direction rather than the opposite one may be supported by the consideration (which empirical evidence confirms) that if the creature were not living, it would not have displayed that particular specific behaviours, whereas if that behaviour had been prevented, it does not necessarily follow that the creature would have ceased to live, since it might have continued to realise the activity of living out its characteristic life-pattern in some different type of change adapted to the circumstances. In view of this distinction between the two aspects of any concrete stretch of unenforced behaviour, and of the causal relation between them, it is perhaps not unreasonable to apply the terms 'agent' and 'patient' to the same organic individual. According to this analysis, it is not the physical matter of the organism (*e.g.* the earth of which it is composed) that is the patient

of self-change, but the organism itself regarded as the subject of those unenforced changes that stand to the life-activity as behavioural matter to behavioural form. The agent, correspondingly, is the organism itself regarded as subject of the life-activity typical of its kind. This agent, moreover, logically resembles such conceptually obvious external agents as the craftsman at work on his materials, in that it too, *qua* agent, is not a subject of change (κίνησις). For the activity of living out a certain life-pattern is not a κίνησις, any more than the activity of building. It is true that for organic substances living has an inbuilt terminus (since death in Aristotle's view is a natural event, not necessarily due to externally enforced interruption: *cf. Physics* V 6, 230a25 - 28). But whereas a genuine κίνησις is defined in terms of the subject's present lack of the property in which the κίνησις naturally terminates, it would be absurd to regard even a necessarily finite life as the privation of the "condition" of non-existence in which it naturally ends. Where a κίνησις defines the nature of a substance, this nature can also be defined by reference to the non-kinetic end-state of the κίνησις: thus it is the nature of fire to move upwards because it is its nature to be in the upper region. If the enactment of a certain type of life-pattern were a κίνησις of its subject, we should similarly have to say that it is the nature of this subject to live out its life because it is its nature to not-exist or "be" dead.

(37) The analysis just suggested of 'self-change' relies only on Aristotelian concepts and distinctions, and employs them so straightforwardly that it is hardly credible that such an account would not have occurred to Aristotle himself, had he been aiming to give one.

But even if he was inexplicably blind to the suitability of his own conceptual apparatus to clarify 'self-change' along such lines as I have sketched, this was hardly to his disadvantage in the present context. For it does not help his main argument to have attention drawn to the unity-in-variety of the natural behaviour of those sublunary beings denominated 'self-changers'; and the possibility of making this unity-in-variety the basis of a coherent explication could only be a source of embarrassment. The more cogent such an explication might strike us as being, the less we should be inclined to accept any other account of the concept: but if we were to settle for this type of account, we could not consistently accept Aristotle's invitation to view the ultimate eternal motion as a self-change. This motion is of necessity absolutely homogeneous, and like those of the sublunary simple bodies offers no purchase for a distinction between the single overall form of behaviour, and the varying behavioural "matter" in which it is realised. If 'self-change' is to apply to the eternal case (and if not Aristotle has lost his argument for an eternal Prime Mover distinct from the *primum mobile* itself) analyses such as the one just given must be firmly ignored. In general I would maintain that Aristotle's vagueness in *Physics* VIII on 'self-change' as applied to organisms is to be blamed on his need to make the same concept cover a case which differs from these in virtually every known feature. The same need also explains his view that an organism changes itself not only when the change of the whole involves some counter-natural change in the bodily material or a bodily part, but even when the tendencies of all the subordinate natures concerned fully harmonise with the natural change of the whole (*v.s.* paragraph (13)). For the uniformity of the eternal motion entails that if the motion is due to the operation of a changer at all, the operation too

must be uniform and continuous; and since this motion is never counter-natural²⁶ (*v.s.* paragraph (30)), contrariety to nature cannot be a necessary condition of its dependence on a changer. Thus as regards sublunary self-changers, Aristotle is compelled to say that the soul always functions as changer of the body (except when the change is due to a physically external force). For even though the changer in the eternal case is not a soul, and the changed nothing like an organic body, still the relation between soul and organic body must resemble the eternal relation, since otherwise what basis is there for predicating 'self-change' in both cases?

(38) These remarks however assume that there is an eternal changer distinct from the *primum mobile*, and so far we have not seen how this distinction is to be explicated. We know only that an adequate account must avoid any emphasis on features peculiar to the sublunary soul-body relationship. Aristotle's own theory of the distinction is presented in Chapter 5, and it is clear from the start that he is not going to fall into the trap just mentioned, because he couches his argument in terms of the most abstract and general of all concepts, *viz.* those of potentiality, actuality, and the presence and absence of a property.

'Let us make another start and consider the following question: If something changes itself, how does it cause change and in what way? Now the object changed is necessarily infinitely divisible. For this has already been shown in our treatise on nature, that whatever is in motion in virtue of itself is continuous. Thus it is impossible that what changes itself should in entirety change itself. For in that case the whole would be both

26. Which is not to say that it is natural, *i.e.* springs from an independent nature. See Appendix to V, *ad fin.*

the cause and the subject of the same locomotion, if it were one and indivisible in nature: it would be being altered and would be causing alteration, so that it would both teach and learn at the same time, and would be producing and being restored to the same health. Moreover, it has been laid down that what changes [or: is changed ('κινεῖται')] is the changeable. But it is through potentiality that this changes, not through actuality.²⁷ That which is potentially so and so passes into actuality, and the change is the imperfect actuality of the changeable. But the changer is already actually so and so; e.g. the hot heats, and in general what generates is that which possesses the form. So the same thing will at the same time be both hot and not hot in the same way. Similarly in all other cases in which the changer must possess the property in the same sense [sc. as that in which the changed eventually possesses it]. So in that which changes itself, there is something that causes change, and something else that is changed.' (257a31 - b13)

(39) What more decisive difference could there be between two things than that one has a certain property which the other has not? Aristotle now needs no tool besides the Law of Non-Contradiction itself for distinguishing agent from patient on grounds that do not presuppose any grouping of diverse changes under a single principle. Since the law holds good even (indeed primarily) of single properties, it guarantees a difference even where the change is change in a single simple respect. However the guarantee can take hold only if it is certain that for every agent and patient there is a property possessed

27. 'τοῦτο δ' ἐστὶν δυνάμει κινούμενον, οὐκ ἐντελεχεύει'. The obvious translation 'This is potentially, not actually, changing', (adopted by Hardie and Gaye (Oxford) and Wicksteed and Cornford (Loeb)) is surely incorrect. This meaning contributes nothing to the argument, which turns on the contrast between the changing subject's potentiality to be in the terminal state, and the actuality of that state, which is also the actual state of the changer. Moreover on this interpretation 'τὸ δὲ δυνάμει εἰς ἐντελέχειαν βαδίζει' would refer to the subject's coming to be actually changing, and although the transition from rest to change is a sort of μεταβολή, Aristotle would hardly have described it as a 'βάδισις'. Themistius and Simplicius *ad loc.* support my rendering.

by one and not the other. This Aristotle ensures by adopting the model of giving and receiving. To change (intransitive) is to acquire a new property, and to acquire is to be given. Hence there must be a giver, and the giver must first possess what it gives. That which acquires does not as yet have what it acquires. Hence what gives is not at the same time acquiring what it gives, for it gives only what it has. So what gives is not being given what it gives, since to be given is to acquire. Thus at one stroke Aristotle achieves the prized results (a) that the changer is distinct from the changed, and (b) that the changer, while operating as such, is not itself changing or being changed in the respect in which it causes change. Moreover, since on this model the giving of the giver depends only on the fact that the giver has a certain property and is in contact with a patient in a suitable condition to receive the latter, it is irrelevant to the giving whether or not the giver is currently changing in any other respect (being given some other property). Thus the changer need not change, or even be changeable, in any respect whatever.

(40) The changer must be supposed to have the property which it then gives. For if the changed could get this property from something not possessed of it, why should the changed not get it from itself - in which case, it would not be a changed, but something which simply of itself originates a change to the new state? On the other hand, the giving/receiving model, if interpreted literally, implies that where the change is in respect of a physical property (as in most of Aristotle's examples) both agent and patient must be physical objects, since each in turn has the physical property. This hardly assists an

argument for an absolutely changeless (and therefore non-physical) first cause which stands to the body whose motion it causes in a relation not totally unlike that of a soul. Thus, as Aristotle hints in the penultimate sentence of the passage last quoted, there must be some sense in which something can be said to "have" (so that it can give) a physical property without being physically characterised by it.²⁸ It might be objected that if there are different senses or ways of "having", so that the same property can physically qualify the changed whereas it non-physically qualified the changer, then the reasoning of the passage breaks down. For the Law of Non-Contradiction does not prevent the subject which has the property in the non-physical sense from being numerically identical with the subject that does not have it in the physical sense. However, this does not hinder the general drift of Aristotle's argument, for he needs only to show that agent and patient are in some way distinct, even if only distinct aspects of the same individual. And he is assured of at least this conclusion, for if a being is capable of the non-physical possession of properties of whose physical possession it is also capable, then it must be regarded as having two dimensions or aspects, a corporeal and (however related to this) a non-corporeal.

28. The condition of desiring some as yet unachieved physical condition would be a way of non-physically "having" a physical property. '... the thought (or image) that one has in one's mind when one knows x is for Aristotle as fully actual an instance of the form of x as an external object exemplifying this form', J. Hintikka, 'Conceivability and Realizability in Aristotle', *Time and Necessity*, p. 126. If Aristotle is identifying the subject's "non-physical possession" of P with P's being an object of perception and/or desire for that subject, this would explain his tendency to confine self-change to animals and to equate it with the distinctively animal change of locomotion.

(44) This stage of the first cause argument bears heavy responsibility for the aura of pseudo-metaphysics which for many still hangs about the whole notion of "inner principles of change". The concept of nature in *Physics* II is not unempirical in the sense that no observation is relevant to its application in a particular case. To say that it is the nature of fire to move upwards implies that regularly fire does so move, and that the motion is not shaped by the external environment. The first of these claims can be verified without difficulty, and the second with no more difficulty than many causal propositions in modern science. Nor does the II 1 identification of nature with form in organised substances put 'nature' beyond the scope of empirical application. Minimally, this identification entails that the regular and externally undetermined changes of the substance cannot be reduced to products of the changes natural to its elemental components. Although false, the doctrine of the natural motions of the elements is to some extent supported by ordinary observation, and if the doctrine is accepted, ordinary observation leads to the conclusion that many substances behave in structured ways not derivable from elemental behaviour. Thus to uphold the notion of form as the source of change there is no need whatever to postulate "within" the substance some kind of incorporeal counterpart of the change or of the result thereby achieved, and in Book II Aristotle showed no sign of being drawn in this direction. We have also seen that the concept of self-changer as applied to organisms can be analysed in terms of externally undetermined behaviour together with the observable fact that this behaviour has the common property of tending to development, survival and reproduction. These facts give sufficient ground for conceptually isolating changer from changed, and on this level it is gratuitous to assume an incorporeal counterpart,

or to identify the agent factor with such an assumed entity. I say 'on this level', because at a logically posterior stage of inquiry it may, in the case of some behaviour of some organisms, seem necessary or reasonable to postulate a state of consciousness, desire and/or perception, as a link in the explanatory chain, and this state may be thought of as being or involving an incorporeal counterpart (mental presentation) of the object desired or perceived. However, we make this move only when the behaviour and physical characteristics are such as to suggest that it would not be absurd to attribute consciousness to the creature in question. For some cultures and outlooks the threshold of absurdity may be lower than for others; thus there have been people for whom, apparently, any directional behaviour, even the fall of stones, indicates a spirit present. But Aristotle like ourselves sets the threshold at a level to exclude not only these cases but many far more complex organic ones; which means that he, like ourselves, is bound to base the attribution of consciousness on characteristics not universally present in all natural objects. And it is fairly certain that any attempt to specify these characteristics, even roughly and open-endedly, will point to features which the eternally moving body lacks, and indeed necessarily must lack if its motion is to be suitable to the metaphysical rôle for which it was cast. In the absence of empirical criteria, Aristotle's only ground for assuming a non-physical dimension to be operative in the eternal case is supplied by the empty verbal logic that pictures change (intransitive) as a receiving, and so as requiring a giver, and therefore a prior possessor, and therefore, if there is no observable prior possessor, one that is unobservable and possesses only incorporeally what it gives, since it must possess it somehow because it could not otherwise give, and nothing could receive from it. But although it is

perhaps only in the eternal case that Aristotle needs this reasoning to assure him of the existence of a cause distinct from the subject of the change, the reasoning itself is presented as general, being allegedly derived from the concept of change as such.²⁹ Thus it logically extends to all areas previously covered by the original concept of nature, imposing on the latter an otherwise groundless³⁰ interpretation in terms of ghostly inner "blueprints" striving for physical embodiment through change.

(42) Such are the twists and turns by which Aristotle seeks to establish an eternal source of change which itself stands outside any actual or possible change, including even the eternal motion which is its immediate effect. I want to end by considering why this position is so necessary for Aristotle. The answer may seem obvious: for theological and perhaps also religious reasons he could not accept that the source of all change is a corporeal object: but this is what it would have to be if the source were itself a subject of eternal change (since the only eternal change is a species of locomotion). The being on which all change depends is the being on which depend all natural substances, since their nature is to change; and the being on

29. Cf. M. de Corte, 'La Causalité du Premier Moteur dans la philosophie aristotélicienne', *Revue de l'Histoire de la Philosophie*, vol. V, 1931, p. 105: '... on ne peut pas ne pas être frappé par l'insistance que met Aristote à ramener toute l'essence de sa preuve à l'unique analyse du mouvement ...'. See also p. 107.

30. See A. Gotthelf, 'Aristotle's Conception of Final Causality', *Review of Metaphysics* XXX, 1976, pp. 226 ff., for an excellent "demythologising" analysis of Aristotle's treatment of sublunary nature. Gotthelf does not however note that Aristotle is himself (by his theory of the eternal changeless cause) in a measure responsible for the "immaterial agency" interpretation against which Gotthelf argues (especially pp. 251 - 252).

which all natural substances depend is God; and God must be changeless and incorporeal. The theological assumptions expressed by the last two clauses are matters for metaphysics rather than philosophy of nature, but it would be absurd to make this a reason for denying their influence on the central argument of *Physics* VIII. On the other hand, this consideration must be balanced against the fact that this argument is not on the face of it an argument for God. Nor is it simply an attempt to find a First Cause. It does of course result in this, but Aristotle's avowed aim in *Physics* VIII 3-6 is to show how there can be individually transitory changes even though change as such is an eternal feature of the universe. And we have seen that although his solution invokes (a) an eternal source of change, and (b) a being that eternally changes, it does not by itself rule out the possibility that what satisfies these two postulates might be one and the same thing. Thus it seems that the assumption of a source distinct from the subject answers to some demand extrinsic to the problem raised in 3 and solved in 6; and if that demand is purely theological, then it is extrinsic too to the general domain of "physics". But now without meaning to discount the theological aspect, concerning which I shall say no more, I wish to draw attention to another pressure operative here, and one whose source lies nearer home.

(43) Instead of debating whether a body in eternal motion is fit to be assigned the position of ultimate source of all change, let us rather consider whether this motion could by the standards implicit in the definition of III 1 be properly described as a κίνησις or motion at all.³¹

31. Philoponus refuses to take it for granted that the III 1 definition of change is equally applicable to finite and to eternal change: see *ap. Simplic. Ad Phys. VIII 1*, Diels 1129 ff., and Simplicius' virulent reply.

The problem is to find a sense in which it could be classed as an incomplete actuality, or alternatively as an actuality of what is potential insofar as it is only potential. The changes that fall neatly under the original definition all naturally terminate in a state of non-change, and the change itself is the actuality that belongs to the subject insofar as it can be but as yet is not in that state. But where there is no future terminal state to be actualised, there can be no present potentiality to be in that state. Thus although the eternally moving body is *ex hypothesi* now moving, it is not now potentially in some later-attained condition of non-movement; and this too is *ex hypothesi*. The conclusion could be avoided if we suppose the eternal motion to be a series of discrete movements to successive static conditions, but Aristotle cannot accept any such hypothesis: for him, it is essential that the motion be as absolutely continuous as it is necessarily everlasting.³² It is true of course that the eternal body is never, during any sub-period of its rotation, actually doing all that it can do. Thus if A, B and C are points on the circular path of some chosen section S of the eternal body, it is true that while the body rotates so that S passes from A to B, it is not as yet actually rotating so that S passes from B to C, yet it possesses the potentiality to be doing so.³³ But this fact hardly serves to bring the motion into line with the earlier definition.

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32. For a brilliant summary of the problems of fitting the eternal circular motion to the III 1 definition of change, see Cherniss, *Aristotle's Criticism of Plato etc.*, pp. 582-583. Cf. also Robin, *Aristote*, p. 132: 'Ainsi, avec ce mouvement [*sc.* le mouvement circulaire], qui est le mouvement par excellence, s'effondre la définition physique du mouvement'. However I argue (paragraphs (44) - (50)) that the position of *Physics* VIII keeps to the definition's spirit if not its letter.
33. Cf. Simplicius *ad VIII 1 contra Philoponum*, Diels 1131, 9-22, and Alexander *apud Simplic.*, Diels 1218, 20-27.

That definition avoided circularity only by analysing change in terms of a potentiality for some form of non-change, whereas the eternal rotation, if it can be analysed at all without prejudice to its absolute continuity, can only be analysed by reference to a series of potentialities to be in motion.

(44) Sublunary changes are incomplete actualities by contrast with the states of complete actuality in which they naturally terminate. But no such contrast can justify the term 'incomplete actuality' as applied to the eternal case. The consequence seems clear: either the eternal motion counts as a complete actuality, or its incompleteness derives from an entirely different type of contrast. As a natural phenomenon, the eternal circular motion is as complete as anything in nature could be.³⁴ Since it never started, it follows that at every moment every part of the rotating body has just completed a circle; and since it will never end, there is never any falling short of a complete number of circles. Thus any actuality by comparison with which it would make sense to describe the eternal motion as incomplete would necessarily lie beyond nature and change, and would be of a perfection inconceivable in natural terms. Nor could such an actuality be brought into existence by any process of change. Hence it must necessarily exist for eternity, making true Aristotle's statement in *Physics* VIII 3 that besides substances that begin and cease to change, there is something in eternal change, and something eternally

34. On the energeic (as opposed to kinetic) character of the eternal rotation, cf. W.K.C. Guthrie, 'The Development of Aristotle's Theology I', *Classical Quarterly* vol. XXVII, 1933, p. 167, note 2; J.B. Skemp, *The Theory of Motion in Plato's Later Dialogues*, p. xi, note 3; L.A. Kosman, 'Aristotle's Definition of Motion', *Phronesis* XIV, 1969, pp. 59-60.

changeless. The point which we stress is that without the eternally changeless, the eternal change could not be classed as a change, so long as this term is supposed to retain some semblance of the meaning earlier assigned it in *Physics* III.

(45) Perhaps when Aristotle framed the definition of III 1 he had no thought for the eternal motion. The celestial spheres and their rotations lay outside the scope of his current concern, this being directed towards the substances and changes whose histories and developments we can follow out from start to finish by our own observations.³⁵ By comparison with these experienced objects, eternal body and eternal change are theoretical entities, whose eternity cannot be observed but only argued for as a necessary factor in the explanation of what we do observe. In the earlier books the need for such explanation did not arise: Aristotle was intent on developing concepts for describing finite change as and when it occurs. We might compare his account of 'the voluntary' in *Nicomachean Ethics* III 1-5: here too his object is to delineate the concept and its criteria, but never at any point to ask how voluntary action is possible. It would have been no surprise, then, if in broaching the new level of discussion in Book VIII Aristotle had quietly left his old definition of change behind

35. Compare II 1, where (a) the examples given of a natural substance are all sublunary, and (b) nature is said to be a principle of change and stasis. However, II 7, 198a29-31 shows that Book II does not totally ignore the eternal world. But this passage says that eternal moving things fall under a different branch of knowledge from destructible changing things: *i.e.* the former do not come within the scope of "physics" as conceived in II. (For a list of the numerous comments, ancient and modern, on the inapplicability of the II 1 definition of nature as a principle of change and stasis to eternal bodies, see P. Moraux, *Aristote, Du Ciel*, p. xlv, note 1.)

as a tool unsuitable for such a different type of venture, and it would be niggling on our part to have criticised him for doing so, especially since twentieth century philosophy of science provides striking illustrations of the way in which concepts of space, time and motion viable on the level of ordinary experience collapse when applied beyond it. But Aristotle himself disallows any such concession by reverting explicitly to the old definition in VIII 1 (251a8-10), and again in VIII 5.

(46) In the course of considering in what sense something can be said to change itself, he writes:

'It has been laid down that what changes (intransitive) is the changeable. But it is through potentiality, not actuality, that it changes.³⁶ That which is potentially so and so passes to being so in actuality, and change is the incomplete actuality of the changeable. But the changer already has the property in actuality: *e.g.* what is hot heats, and in general the generator possesses the form. So [*sc.* unless even in the self-changing there is a distinction between changer and changed] the same thing is hot and not hot at the same time in the same respect.' (257b6-11)

Here Aristotle firmly anchors himself to the account of change given in III. According to III 1 the complete actuality by contrast with which the change is an incomplete one, is the terminal state achieved through unimpeded change. Moreover (*cf.* III 2, 202a9-12), the complete actuality (or another instance of it) belongs also to the agent of change, being what constitutes it a possible agent of this type of change. This suggests that one formal feature of complete as opposed to incomplete actuality is the power to reproduce itself (or produce a replica of itself) in some other subject. The change in the patient

36. *Cf.* footnote 27 above.

is the acquiring of this replica-actuality, but the acquiring itself is not a replica of anything currently present in the agent. If it were, then the agent too, at the moment of acting, would be acquiring the complete actuality which it must already possess (hence not now be acquiring) in order to be an agent of this kind. Now the question is how eternal locomotion, or indeed locomotion in general, fits into this conceptual scheme. It is to be noted that the scheme as presented by Aristotle in the passage just quoted is intended to cover all cases of agency and patiency, those where the action is between mutually external substances, as well as the peculiar case of self-change. (Indeed the whole bent of Aristotle's analysis in VIII 5 of the difference between changer and changed in the self-changer is in the direction of logically assimilating their relationship to the external type of case.)³⁷ But one body in locomotion can transmit locomotion to another: can carry another along in its own direction. Thus according to the model, locomotion functions logically as a complete, because self-reproducing, actuality. When a moving body A causes motion in B, the only change that occurs in B, according to Aristotle's conception of "change", is B's acquisition³⁸ of locomotion, but not the locomotion acquired. If the locomotion acquired by B were a change in Aristotle's sense, it would be an incomplete actuality. The same then would be true of the locomotion in the agent A. But it

37. Cf. Solmsen, *Aristotle's System*, pp. 248-249: 'As long as it is at all possible, Aristotle continues to think in physical terms; even of the self-mover he speaks as though it were a body [better: a conjunction of bodies (my insertion)] and had extension and parts.'

38. It may seem odd to speak of the acquisition of locomotion as a change (*κίνησις*), since it must be instantaneous. But Aristotle's own example of becoming hot (257b9) is also for him instantaneous.

is because A is in locomotion that it is able to cause locomotion in B. Thus A *qua* agent would be in a condition of incomplete actuality: which flatly contradicts the system of concepts with which we are dealing.

(47) But Aristotle is so mesmerised by this system and at the same time so certain that locomotion is of course to be counted a change or κίνησις (at 9, 266a1-2 he mentions that the word 'κίνησις' is strictly applied only to locomotion) that he altogether overlooks the problem. At 5, 256b31-257a3 he writes as if the same absurdity attached to the proposition that a subject is both in locomotion (in a given direction etc.) and causes such locomotion in something else, as to the proposition that a subject is both learning and teaching the same lesson to another.³⁹ Certainly, if being in locomotion is an incomplete actuality (like learning), then locomotion (like learning) could only be caused by an agent not itself in locomotion

39. Assuming that particular attributes (including changes) are individuated by reference to particular subjects, X cannot be both subject and cause of L in another subject, where 'L' refers to the same particular locomotion. (But it is arguable that Aristotle does not share the assumption; *c.f.* G.E.L. Owen, 'Inherence', *Phronesis* X, 1965, pp. 97 ff.) However this cannot help Aristotle here: if locomotion is to count as κίνησις in his scheme, it must be impossible for the agent to be in and to cause specifically the same locomotion. For it is in this sense of 'same' that an agent's supposed possession of complete actuality entails its not undergoing the same process as it causes. This is clear in the case of 'teaching'. Still, it might be said that on a narrow definition of 'specifically same locomotion' in terms of points traversed, different spatial objects cannot undergo specifically the same locomotion at the same time; so that Aristotle is justified in holding that with locomotion as with other types of κίνησις an agent cannot undergo what it causes. But the fact that (in some cases) the agent is as such in locomotion at all still shakes Aristotle's scheme; for this requires not merely that the agent not be undergoing the change which it causes, but that *qua* agent it be in a state of non-change, complete actuality.

(learning) but in some sense already in possession of the place arrived at through locomotion (already in possession of knowledge).⁴⁰ Aristotle simply asserts the antecedent of this hypothetical, and therefore the consequent, without stopping to consider whether experience does not present grounds for denying the consequent and therefore the antecedent. If he had, he would have been faced with the necessity of abandoning either the assumption that locomotion is in all cases a κίνησις or the proposition that κίνησις is in all cases incomplete actuality. Now what shields Aristotle from realising this is, I suggest, his certainty that locomotion, and in particular eternal rotation, depends on an agent distinct from its subject.

(48) To explain this, let us recall the assumption behind Aristotle's argument in VIII 4 that the natural movements of the sublunary simple bodies are agent-dependent. The only agents to be found were the generator and/or liberator. Now to call these 'agents' presupposes that the simple bodies are, in their natural motions, patients. And Aristotle's only reason for regarding them as patients of their liberators, etc. was the fact that it is a change or κίνησις that these alleged "agents" make possible. If the upward motion of fire were (*per impossibile*) a non-kinetic activity or ἐνέργεια in the narrow sense of *Metaphysics* Θ 6, then the liberator, although he might still be necessary, would not count as an agent. For the ἐνέργεια is not a passivity, hence its subject not a patient. It would be absurd, for instance, to think of a living thing as passively receiving the

40. Cf. Philoponus in VIII 5, 257b9, Vitelli 835, 1-3: 'ἀλλ' οὐδὲ ἐπὶ τῶν κατὰ τόπον κινούντων ἀληθῆς ὁ λόγος· οὔτε γὰρ αἱ ἡμίονοι αἱ κινεῖσθαι τὴν ἄμαξαν ἐνέργεια εἰσὶν ἐν τῷ τόπῳ ἔνθα δεῦ πορευθῆναι.'

ἐνέργεια that is its own life-activity. The assumption, then, in VIII 4 was that only κίνησις requires an agent.⁴¹ Now the natural motions of the sublunary simple bodies are clearly incomplete actualities, so they fit the definition of κίνησις in III 1. The criterion of their incompleteness, hence of their kinetic status, is that they proceed to a termination-point. And in VIII 4 their status as passivities was assumed to follow from this already established kinetic status. But to turn now to the case of the eternal rotation: here Aristotle lacks the criteria upon which he has so far been relying to divide kinetic from non-kinetic, incomplete from complete. If he takes the criterion to be 'proceeding to a termination point', then the eternal rotation is not incomplete. If he takes the criterion for complete actuality to be the power of self-replication, then locomotion of all kinds must often count as complete. There remains one path of escape from the obvious conclusion, and Aristotle in my view follows it. This is to convert agent-dependence from a necessary consequence of kinetic status into a criterion for the same, where all other criteria fail. Thus it is because (as he never in *Physics* VIII doubts) the eternal rotation has a distinct agent that we can continue to class it as a κίνησις. Conversely, if we supposed it to stand in no need of an agent, with the eternal body functioning as the self-sufficient subject and source of its own motion, we would automatically put it outside the class of κινήσεις, in the absence of any other reason for calling it 'incomplete'.

41. V.s. Chapter IV, paragraphs (12) and (13).

(49) Earlier (paragraphs (27) - (28)) it seemed that Aristotle's postulate of an unchanging agent for the primary eternal motion was logically superfluous in his account of the infinite succession of finite changes: that the eternal motion by itself would have been enough. But it is plain now that the changeless agent is an essential element in the conceptual structure set up in VIII 6, and for reasons unrelated to theology. One local effect of questioning the existence of the changeless agent, let alone of denying it, would be to spoil the smooth move by which Aristotle argues for an eternal motion in the first place. Variation in the sublunary world cannot, he holds, immediately stem from the absolutely changeless; hence there must be eternal change to supply the intermediate link (*v.s.* paragraphs (23) - (24)). But if the change is conceivably independent of an agent, then since dependence on an agent is the one characteristic that sets this process in the category of κίνησις as opposed to ἐνέργεια, it follows that the presumed intermediary might not be a κίνησις. But how, if it were not, could it fulfil the mediating function for which it was postulated, *i.e.* to connect the changeless with the variable? If eternal rotation is ἐνέργεια, then what does it have in common with sublunary transient κίνησις that fits it to bridge the causal gap between them and the ultimate cause?

(50) But this problem is minor compared with the main difficulty that comes to light once we scrutinise the conceptual rôle of the changeless eternal agent. What begins to emerge is the fundamental weakness of Aristotle's basic equation of change with incomplete actuality. Suppose that it were allowed that the primary eternal rotation is agentless. Then it would have to be classed as complete

actuality, and it would not figure as κίνησις. (Here again we find that the cause of a possible κίνησις has to be established before it can be assumed that the phenomenon in question is one; v.s. Chapter III, paragraph (38).) But no amount of juggling with classifications can obliterate the palpable difference between this sort of complete actuality, which involves passage through space, and a static one such as being at a place. And the philosopher cannot argue away the fact that for ordinary thought at least, this is the difference between change and staying put, between motion and rest, between process and the static. But this difference is not captured by the distinction of complete *versus* incomplete actuality which inspires Aristotle's III 1 definition of κίνησις. On the contrary, the common-sense distinction between *e.g.* locomotion of whatever kind (whatever its cause) and rest, cuts across the class of possible complete actualities, bracketing at least one member (the eternal rotation, supposing this possibly agentless) with sublunary motions classed as incomplete.

(51) Yet for Aristotle, even in *Physics* VIII, the dichotomy 'complete/incomplete' continues to express the essential difference between non-process and process (although passages in *Physics* VI may represent an abortive effort in another direction). The reason, I suggest, is that in the *Physics* he never recognises as possible the case that would drive a wedge between the two distinctions; this is the case of agentless eternal rotation. He can rest assured that the distinctions are synonymous as long as he is assured that they coincide, and he can be certain of their coincidence because he is certain that all processes (that common sense would recognise as such, including all locomotions) are incomplete, whether because self-terminating, or because agent-

dependent, or on both counts. Once faced with the possibility that even one process (let alone that on which all others depend) has neither of these characteristics, Aristotle would have had to recognise that *III 1* has failed to define process or (since the concepts are there equated) change. Recognition is kept at bay only if the eternal rotation is assumed without question to be due to an agent. In short, Aristotle's definition of κίνησις in *Physics III 1* stands or falls with the *Physics VIII* doctrine of the distinct eternal agent. But in that case his dubious manoeuvres in *VIII 4-5* with 'self-change' cannot properly be described as an argument for the existence of that agent, seeing that the "argument"'s conclusion has already been begged by his assumption that eternal rotation is a κίνησις, together with his continued adherence to the notion of κίνησις as incomplete actuality. Suppose, on the other hand, that we allowed the argument for the agent to pass as a genuine piece of reasoning to a conclusion not presupposed: in that case, this reasoning must also be regarded as Aristotle's defence (conscious or not) of the idea of κίνησις as incomplete actuality. We earlier saw (*v.s.* paragraphs (15) - (17)) how his initial concept of natural substance is buttressed in *Physics VIII* by the doctrine that change is an eternal feature of the universe. Just so, we now see too how Book *VIII*'s theory of the eternal changeless agent is required to sustain his original definition of change.

APPENDIX TO CHAPTER V

In the main text I argued as follows that the concept of self-change plays an essential part in establishing the position reached by Aristotle in *Physics* VIII 6: (1) He is not logically entitled to postulate an eternal cause distinct from any eternally moving body merely on the ground that otherwise there could be no infinite sequence of finite changes, since this sequence could be adequately accounted for by eternal motion alone. (2) His ground then must be that eternal motion in turn requires to be explained, and this is possible only on the assumption of a distinct and changeless ultimate cause. (3) But such an explanation would be unnecessary on the view that an eternally moving body is like fire or earth, *i.e.* simply of a nature to move as it does, because then there would be nothing for a distinct mover to do. (4) Therefore (since there must surely be some sublunary analogue to assist our understanding of the ultimate eternal motion) Aristotle compares the motion to the natural locomotion of a living thing. (5) A living thing involves a cause of motion (the soul) which is in some sense distinct from that which moves (the body), and which is not itself a body, and which (*qua* source of change) is not itself changing. (6) If, then, the ultimate eternal motion is analogous to soul-directed movements in an organism, this motion too must have an in some sense distinct although not physically external cause. (7) Thus provided that Aristotle can show that the ultimate eternal motion is the manifestation of a mover-moved complex analogous to the complex of soul and body (*i.e.* that the motion is the manifestation of a self-mover), he has the proof he needs, but not otherwise (given his starting position in *Physics* VIII). Now, he tries to meet the proviso by arguing that every series of changes starts with a self-changer, and this is where his proof breaks down, since the proposition is groundless in his system according to the Aristotelian meaning of 'self-change', although not, as we saw, according to the Platonic.

However, proposition (3) above needs fuller discussion than there was space for in the text. As against H. von Arnim (*Die Entstehung der Gotteslehre des Aristoteles*) who maintained (3), W.K.C. Guthrie, followed by H. Cherniss, holds that the distinct changeless cause is not redundant even if the subject of eternal rotation is endowed with a nature to rotate (Guthrie, 'The Development of Aristotle's Theology' (I), *Classical Quarterly* vol. XXVII, 1933, and introduction to Loeb *De Caelo*; Cherniss, *Aristotle's Criticism of Plato and the Academy*, App. X, pp. 584 ff.) Guthrie in fact claims not merely that the doctrine of eternal body as natured to rotate is consistent with that of the changeless agent, but that the former doctrine is incomplete without the latter.

The scholars just mentioned were especially concerned with the *De Caelo*, but their views have implications for the argument of *Physics* VIII, and especially for any assessment of the function of "self-change" in that argument. If Guthrie and Cherniss are right, "self-change" is an unnecessary complication. If it is possible to argue for the changeless eternal agent even on the assumption that the *primum mobile* is, as in *De Caelo* I, of a nature analogous to that of fire etc. then Aristotle had no need to introduce a special

category of natural changes (self-changes) from which those of fire etc. were carefully excluded. Nor need he have insisted on the distinction between internal agent and patient within the so-called self-changers. His purpose of arriving at the position of VIII 6 would have been equally well served if he had adhered to the II 1 conception of nature as an inner principle without subdividing natural substances into self-changers and non-self-changers. (This is not to say that he would have regarded them as all alike ensouled or not ensouled, but that this difference would not have mattered for the argument.) Or if, when treating of eternal things, his sense of continuity with Platonic tradition inclined him to use the Platonic term 'self-changer' in this context, he could have used it without adding the un-Platonic assumption that it implies a distinction between changer-self and changed-self. In that case, the term would have functioned as an equivalent to 'originator of change', and have applied as well to fire etc. as to organic creatures: in short, it would have been a Platonically-tinged synonym for 'natural substance' as explained in II 1.

It is Aristotle's refusal to use 'self-change' in this simple sense, and his insistence on the internal distinction, that generates the serious doubts and obscurities which we surveyed near the beginning of Chapter V above. Thus if Guthrie and Cherniss are right, these doubts and obscurities are not (as to me it seems they are) the necessary price for an otherwise coherent argument culminating in VIII 6; for the concept which generates them, the concept of "self-change", turns out to be an unhelpful intruder. It is not incredible that Aristotle should have failed to realise this; indeed Guthrie seems to suggest that it is not until *Metaphysics* A (where 'self-change' does not appear) that he reaches a coherent position concerning the Unmoved Mover.

To support his claim of compatibility between the doctrine of eternal body as having a nature like that of fire, and the postulate of a distinct cause of its motion, Guthrie maintains that the concept of nature undergoes development in the *Physics*, its original meaning being supplemented by a new metaphysical refinement.

'[According to] the principles of the first books of the *Physics* ... change and motion is to be regarded as the actualization of a potency. This actualization takes place because the φύσις of things is something dynamic, an inward urge towards the realization of form. But by the time the investigations of the *Physics* were completed by the theories of books VII and VIII, A. had logical proof of what he had always believed to be true, but would not allow himself to state until the proof was ready to hand, namely that this inward urge would remain dormant unless there were actually existent some external perfection to awaken it, by instilling the desire of imitation, in so far as that was possible for each thing in its own particular mode of being.'
(*Classical Quarterly*, 1933, p. 171)

(Since Cherniss does not question these remarks, presumably he would

not reject them.) I shall not consider whether Aristotle had 'always' held the belief attributed to him in the last few lines, but only whether he holds it in the last book of the *Physics*. For, clearly, if he does, then he holds there that a thing moves because of its nature and because of the eternal Unmoved Mover (the latter being what Guthrie means by 'some external perfection'). Now if in particular this is Aristotle's view concerning the *primum mobile* of *Physics* VIII, then the latter's dependence on the eternal Unmoved Mover is no reason against his retaining the *De Caelo* I analogy between the *primum mobile* and fire, earth, etc. Thus the *Physics* VIII comparison of *primum mobile* with a self-moving organism, and the implied contrast with inanimate substances, contributes nothing to the main argument of that book.

In the passage quoted Guthrie starts with the concept of a nature as an active principle (that on account of which a substance changes in a certain way unless prevented), and then distinguishes within this two metaphysical factors: one is the ground of there being any change at all, which he identifies with the urge or desire to imitate the absolute perfection of the eternal Unmoved Mover, while the other is that which determines the particular way in which the imitation of absolute perfection will be realised in the particular case. It is the second factor that Guthrie identifies with nature in the "developed" account. Clearly, 'nature' in the latter sense (in which it refers not to an active or dynamic principle but to a metaphysically distinguishable component of a dynamic principle) is consistent with and indeed entails (final) causation by the Unmoved Mover. But it is doubtful whether in *Physics* VIII (whatever may be the case in the *Metaphysics*) Aristotle ever uses 'nature' in this sense. For in this sense of 'nature' the Unmoved Mover is present (as final cause or object of imitation) with equal immediacy to the natures of all natural substances - or perhaps we should say, with equal remoteness. There is nothing "between" the absolutely perfect being and the substances that try through change to imitate it, except the metaphysical gap between finite physical perfection and absolute changeless perfection; and this gap is the same for all changing substances. But in *Physics* VIII the eternal Unmoved Mover is in a special sense separated from sublunary substances, because they depend on it only at physical removes, *via* the mediation of the eternal spheres and in particular the outermost. This fits with the analogy Body: Soul :: Eternally rotating outermost sphere: Eternal changeless cause, because a soul is intimately related to one body, and to other physical substances only *via* this body. (For a penetrating discussion of this question see M. de Corte, *Revue de l'histoire de la Philosophie* V, 1931.)

It is therefore a reasonable conclusion that in *Physics* VIII Aristotle is not using 'nature' in Guthrie's narrow and metaphysically analytical sense. If he is not, then presumably 'nature' continues in VIII as in II to signify the dynamic principle, or that about a substance on account of which it does change in a certain way unless prevented. But a substance endowed with nature in this sense cannot depend for its change on anything other than its natural self except insofar as the change can be hindered. That is, it depends on favourable conditions and on whatever is responsible for those conditions.

Thus the statement that a sublunary substance changes by its own nature does not exclude the ultimate dependence of this change on some external unmoved mover; for the eternal motion caused by the latter may be supposed to keep going (by however many causal stages) the seasonal conditions and developments that make possible the sublunary natural change. However, in such cases, the natural change depends on the eternal agent only because it depends more immediately on physically external conditions. Where there are no external conditions or possible hindrances, as in the case of the primary eternal change, there cannot be an agent whose responsibility for the change consists entirely in its ensuring the continuance of favourable conditions. Either there is no agent or the agent does more than create the possibility of change. So if the primary eternal motion has a distinct eternal agent, this can only be because the agent determines the motion, not because (as with sublunary substances) it makes possible the motion already determined by the substance's nature. If then the *primum mobile* were by nature determined to move as it does, there would be no function for a distinct agent. Nature (in the sense of dynamic principle) is not in general incompatible with dependence on the eternal Unmoved Mover, but it is so in the case of the first eternal body because of this body's unique independence of physically external conditions.

In *Physics* VIII Aristotle goes to great lengths to prove that there is at least one eternal change and that it is circular locomotion. Yet (by contrast with *De Caelo* I) he never says that this change stems from its subject's nature. The eternally moving body is never said to have a nature at all. This is evidence that (*pace* Guthrie) Aristotle in VIII uses 'nature' as meaning 'dynamic principle', and that he is now aware of inconsistency in attributing nature in this sense to an object immediately kept in necessary motion by the ultimate cause.

It might be argued as follows that even on the scheme of *Physics* VIII the object could be said to have a nature: this object is to its changeless cause as body to soul in sublunary organic self-movers, and the bodily matter of an organism even considered in abstraction from the soul is said in VIII 4 to have a natural tendency which may or may not coincide with the natural tendency of the body-soul concrete as a whole. But would we be entitled to attribute to the bodily matter its own nature were it not the case that sometimes the natural change of the organism as a whole goes against this by a kind of constraint? If the tendency of the bodily matter were always and completely in harmony with that of the whole, then the former could be said to have its own nature only on the grounds that when it decomposes it will yield simple stuffs whose actual natural motions differ from those of the living organism (*cf.* Chapter II, paragraph (35)). Since an eternal body cannot decompose, the *primum mobile* has no nature of its own in this sense, nor in the sense of requiring to be constrained to move as it does. The point could be discussed more fully, but enough has been said to show that Aristotle had good reason to refrain from endowing the *primum mobile* with any kind of a nature, given that he makes its motion depend upon a cause distinct from itself.

It may seem unduly paradoxical that this body, which is after all a physical object, should not possess a nature (in the sense of II 1) and hence fail to qualify for the category of natural substance.

Yet *Physics* VIII entails this, just as *Physics* IV entails the paradox, which Aristotle openly accepts, that the *primum mobile* has no place (IV 5, 212b8-10). We may recall too the *De Philosophia* (see Cicero, *De Natura Deorum*, ii, 16, 44), according to which the motion of the heavens is voluntary, and voluntary change is neither natural nor enforced, but forms a third category. A being whose only motion is voluntary must be presumed not to possess a nature in the sense of principle of natural change; thus the concept of a nature-less physical substance was not at every stage alien to Aristotle. This is not to say that the position of *Physics* VIII requires him to hold that the *primum mobile*'s motion is voluntary; the triple division of *De Philosophia* is of interest here not on account of its positive characterisation of the third type of change, but because it recognises that 'natural' and 'enforced' do not exhaust the possibilities, and are equally unsuitable to describe the primary motion.

It may be disturbing to have to admit the existence of a moving physical object that stands in causal relation to other physical (and natural) substances, yet is natureless itself; but this is the lesser of two conceptual evils. For in denying a nature to the *primum mobile*, we are safe at least from being compelled at the same time to assert one; whereas in asserting one, we should also have to deny it. If the *primum mobile* is of a nature to rotate, then (given that this excludes a distinct agent) the rotation is not a change or *κίνησις* in Aristotle's sense of 'incomplete actuality' (so we argued in the text); but then since 'nature is an inner principle of change or *κίνησις*', the "nature" that thus manifests itself is not after all a nature.

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